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Study the Safety Rules

SAFETY rules of the Bureau of Standards are now being issued with an invitation for consideration and criticism that no one who is affected has any right to ignore. The motives of the bureau in drafting the rules were set forth in the article by Dr. S. W. Stratton, published in the ELECTRICAL WORLD of Dec. 19, 1914, and in the articles by Dr. E. B. Rosa in the issues of April 3 and April 10, 1915. Now that the code is out in tentative form, the very serious responsibility rests upon the industry of subjecting the details to the careful scrutiny which the bureau plainly welcomes. Before the conference which has been called for July 1 and 2 there is time for study, not only by companies but also by representatives of associations whose members are vitally interested. Through conferences with representatives of the bureau, an opportunity has been given to many officials of electrical properties to follow the progress of the work; but they should not delay submitting criticisms in concrete form. The recommendation of the bureau that the rules be adopted experimentally for one year before final promulgation is wise and just, but it does not remove the necessity for prompt action now.

Encouraging Export Trade

AN argument for definite government approval of manufacturers' combinations on export trade is suggested by the interview with Mr. Calvert Townley published elsewhere in this issue. Since selling expense is a heavier factor in total cost throughout South America than in this easy-going country, it increases the problem of the small manufacturer who seeks export markets. The simple, obvious way in which the government can promote foreign trade is by permitting small manufacturers to enjoy the advantages of co-operation that their European competitors receive from more paternal, commercialized governments. By directing its influence toward the removal of this difficulty the Federal Trade Commission will do constructive work of great benefit to export trade.

Company Service and Public Service

MR. CARR'S appointment to the New York Public Service Commission of the Second District gives that body a member who is thoroughly familiar with the company point of view on public policy. His practice as one of the attorneys for a large electrical manufacturing company and his position as an official of the Schenectady Illuminating Company have given him first-hand information about utilities, which is conspicuously rare among new commissioners. His experience fits him better to regulate companies than if he had put in the same time in serving the public politically in various offices. The need of the times is not partisan insistence for one side or the other, but statesmanlike recognition by each interest of the clear rights of the other and co-operation in a policy that assures economy, development, reasonable profits at fair rates, and good service. The opportunities in this direction are greatly multiplied for a commissioner who has had actual contact with daily utility problems.

Dielectric Properties of Insulators

THE properties of dielectrics are being investigated at the present time more actively than heretofore, on account of the general rise of electric pressures in long-distance energy transmission, and also on account of the great economic importance of insulation in underground cables. An interesting theory of dielectric fatigue is elaborated by Mr. Karl Willy Wagner in a recent number of the *Elektrotechnische Zeitschrift*, as referred to in our Digest. It is pointed out that when two dielectric layers are placed in series, between parallel plates, and operated as in a condenser, there can be no electric equilibrium in the composite dielectric unless a certain arithmetic relation exists between the conductivities and the inductivities of the two materials. In general this relation cannot be expected to occur, so that dielectric fatigue ensues. Although the reasoning is carried out for the relatively simple case of two separate layers of different dielectrics, yet it is pointed out that the same nature of effect must occur in any single dielectric when non-homogeneity presents itself, so that the phenomena of fatigue and polarization in a dielectric are attributable to either actual or virtual discontinuities and inhomogeneities in its substance.

Educational Publicity Work

IN time of peace prepare for war is an injunction that public utility companies may profitably keep in mind. When all is going smoothly it is usually the policy to defer or forget educational publicity work. Then comes the expiration of a franchise, a municipal-ownership movement, a demand for rate reduction, or some other menace, possibly in the midst of a political campaign. It is almost impossible for the company to obtain a hearing under such circumstances, and yet publicity experts tell us that it is only when a com-

pany is in trouble that they are called in. Situations that can be met by educational effort can usually be anticipated, and a campaign can be begun before public opinion has become set one way or the other. Once a community has made up its mind or had it made up for it, there is little hope of a change within the short period of time that a verdict is rendered. Comparison is often made between the "court of public opinion" and courts of law. There is this important difference, that the court of public opinion is swayed by prejudice and clamor. In such an atmosphere a protestant can scarcely make his voice heard, much less regarded. To secure a fair hearing it is necessary for utility companies to speak out before the mob spirit comes into being and before the thinking minority has reached conclusions on a one-sided or wholly misleading presentment of the case. The fear of stirring things up is a frequently used but nevertheless very poor reason for delaying educational effort—provided always that the utility company has a good case to lay before the public. If it has no case that it dares to present, there is, of course, no right time for saying the wrong thing. But the right time to say the right thing on behalf of utility companies is early—and often.

Electric Drive for Battleships

Electrical and marine engineers will welcome the news that the United States ship *California* is to be equipped with a complete electric drive, the first on any battleship in the world. This vessel will be one of the most powerful battleships in existence, and the selection of the electrical method of propulsion for her will tend to increase her formidable characteristics. It seems at first thought a somewhat roundabout application of power to install a boiler, steam turbine, generator and motor equipment in a ship instead of the customary engines or turbines directly coupled to the screws, but all the evidence at hand seems to indicate that it is really a case of the longest way round being the shortest way home.

In fact, the ship designer who attempts to take advantage of the superior economy and light weight of the steam turbine finds himself caught between low turbine efficiency at low rotative speeds and low propeller efficiency at high speeds. Consequently, in spite of the distinguished success that has already attended the use of turbines, they never have been quite able to appear at their very best when one reckons the plant efficiency straight through from the boiler to the thrust on the propeller shaft. With the electric drive the turbine can be worked at its most efficient speed in spite of the variation in speed of the ship, and the propellers can be so designed as to become highly efficient over any desired range of speed. By using high turbine speed the equipment is lightened in spite of the added weight of the generators and motors, and, what is perhaps almost equally important, no special turbine for reversing the propellers is necessary, since the motors themselves can be very easily reversed.

From results already attained there is every reason to believe that the net efficiency of the propelling mechanism of the *California* will compare favorably with that of any ship driven directly. In fact, the gain in economy is likely to be enough to make the electric drive worth while had it no other marked advantages, particularly since it is cheaper than the direct steam equipment. The saving in the cost of propelling mechanism in the case of the *California* is said to be about $200,000 in addition to the saving in weight, which means more available buoyancy for fuel, armor or battery. Apart from all these advantages, there is still another one which may ultimately become of considerable importance, namely, the ability to place the prime movers and the boilers in the most convenient position for the complicated organism of a warship. It is by no means certain that the locations now usual are the very best that can be devised when one is freed from the mechanical connection between the engine and the propeller shaft. Be this as it may, a great step forward has been taken in "trying out" the electric drive in the *California*, and the evidence already in hand makes it clear that the Navy Department may confidently look forward to success in this important test.

Analysis of Unbalanced Systems

A perfectly balanced three-phase load, like a pure sine wave, is a mathematical fiction which is never completely realized in practice, though usually approximated to a sufficient degree to warrant the assumption of perfect balancing in practical calculations. Yet there are instances which frequently arise in practice where the degree of unbalancing is such that the actual conditions must be taken into account, if one wishes to obtain even a rough idea of the reactions involved. The reluctance of the electrical engineer to venture into such a mathematical analysis is but natural, for not only must the circuit be treated as a Kirchhoff network, but each voltage and current must be resolved into two components. The number of equations involved therefore quickly reaches the saturation point, or, one might say, the "hopeless" point, and the waste basket is likely to exert an irresistible attraction for the papers of the calculator.

Those who have attempted such calculations will therefore welcome the method developed by Dr. L. G. Stokvis and described in detail in this issue, whereby many of the complications are avoided. The method is based upon the principle that any unbalanced load may be resolved into two balanced loads, with the sequence of phases in one of these loads reversed. The current corresponding to the balanced load which has the same sequence of phases as the actual load is called by the author the "synchronous" component, and the current corresponding to the balanced load with the sequence of phases reversed is called by the author the "inverse" component. The determination of these two components for any degree of unbalancing is readily effected by means of two simple formulas. The author

shows that a perfectly balanced load is merely the limiting case when there is no inverse component, and that a single-phase load is another limiting case in which the synchronous and inverse components are equal and each equal to the value of the single-phase current divided by $\sqrt{3}$. The method, therefore, is applicable to any degree of unbalancing.

The author applies the principle in question to the calculation of the regulation of a three-phase alternator delivering an unbalanced load and to the calculation of the third harmonic produced in the terminal voltage as a result of the unbalancing. One sees so often the statement that a third harmonic cannot appear in the terminal voltage of a three-phase alternator that it may at first sight seem surprising that a third harmonic of any practical importance could be produced by any unbalancing of the load. However, the author shows very clearly the origin of this third harmonic, and makes clear that its existence is not only possible but that when the unbalancing is excessive its value may be of practical moment.

Associated with the production of this third harmonic is the production of a double-frequency voltage in the field coils and exciting circuit. The value of the current produced by this double-frequency current may, under excessive unbalancing, be sufficient to operate the circuit-breaker in the exciting circuit, and when the breaker opens it is shown that the voltage induced in the field coils may be sufficient to produce disastrous results. The principle of resolving an unbalanced load into its synchronous and inverse currents can probably be applied with equal success to the analysis of any kind of unbalanced conditions, as, for example, the analysis of the performance of a single-phase induction motor or of a polyphase induction motor when unequal resistances are inserted in the secondary phases during starting. The principle is well worthy of careful study by any one who may be called upon to "look for trouble" due to unbalanced conditions in a polyphase system.

Lumen Rating of Lamps

In the application of the physical sciences to the arts and industries of life, there seems to be a fairly definite order of intellectual growth and procedure relating to measurements and units of measure. A beginning seems usually to be made on polar notions, involving action at a distance. Then, as facts and experience accumulate, these notions break down from insufficiency and are replaced by notions of flux, or surface integrals of action, the distance conception becoming relegated to a subordinate place in the working theory.

Perhaps the clearest case of this progression of ideas is presented in magnetics. Our fundamental units of magnetism are based on the mechanical forces which magnetic poles can mutually exert at intervening distances. Our first working theories of magnetic phenomena were likewise based on the actions of poles falling off as the inverse squares of distances. As engineers became familiar with the phenomena of magnetism and electromagnetism, these notions were found to be inadequate, and they broke down. The magnetic units remained unchanged in magnitudes, although they carried the scars of the old wounds in the shape of unseemly 4π factors; but the conceptions of the magnetic phenomena were changed almost out of all recognition by the introduction of magnetic flux. This more modern and certainly more complex notion has completely ousted the earlier notion of poles acting at a distance.

In electrostatics there exists a sort of intermediate stage of development in ideas. There is no longer a complete reliance upon the attraction of electric charges across intervening distances, such as once existed universally, and upon which the electrostatic units were based. On the other hand, the notions of electrostatic flux and flux density are in only partial use among engineers. Electrostatic-circuit ideas have not yet been developed at large nearly to the same extent as magnetic-circuit ideas, but the development is evidently going on.

In radiation the primitive ideology is beginning to break down, but the stage of development is lower than that which exists in electrostatics, and still lower than that which exists in magnetics. Our units of light are still based upon the polar action, at a distance, of point sources, like that of magnetic poles or of electric charges. Notions of candle-power are derived from such polar points acting inversely as the square of the distance. However, as illuminating engineering has advanced, it has come to recognize the inherent incapability of these polar conceptions and to seek for a more useful substitute in luminous flux. It is becoming more customary for illuminating engineers to use lumens, or units of light flux, rather than candles or lumens per steradian. Certain advantages in simplification in calculation result from substituting the lumen for the candle-power conception in expressing not only the output but also the appearance of a light source, just as is true when the flux conception is substituted for the magnetic-pole conception in expressing total magnetism and magnetic concentration. Obviously, care must always be exercised in interpreting any analogy between magnetic and luminous fluxes in view of the fact that magnetic fluxes form closed curves while light travels in straight lines.

In the *Electrician* of London there was recently published an abstract of a paper by Mr. Francis W. Wilcox, presented before the (British) Illuminating Engineering Society. In this paper the need for and the growing prevalence of the lumen and the lumen ratings is clearly expressed. There is strong probability that, just as the units of flux and flux density have become primordial in magnetics, so the units of flux and flux density are destined to become primordial in photometry. Ultimately, in the continued development of scientific ideology, consolidation and simplification may be effected of all the physical fluxes so that each science will merely adopt its own particular aspect of the fundamental and universal unit, but at present that goal seems remote and polemical.

LETTERS TO THE EDITOR

Clearing House for Electrical Associations

To the Editor of the ELECTRICAL WORLD:

SIR:—In reply to your letter I advance for your consideration a suggestion which came from our counsel, Mr. Thomas M. Debevoise.

If the several organizations now existing in the electrical industry are willing to co-operate with one another, some permanent body is desirable through which that co-operative intent can become practically effective. If each of the organizations will appoint one or two of its members to sit from time to time with like representatives from all of the other associations in a clearing house of the electrical industry, the desired permanent body will be available for the interchange of information and help between the memberships of the several associations. Perhaps such a body can find accommodations in New York City with one or another of the organizations that already are well accommodated—for instance, the American Institute of Electrical Engineers.

As an illustration of the usefulness of such a clearing house, I refer you to a problem now attracting the attention of the electrical inspection authorities, namely, the proper construction, and performance when tested, of electric fixtures intended for use with gas-filled lamps. Diversity of designs, some perhaps not considered with reference to the fire hazard, are now prompting the Underwriters' Laboratories, Inc., to consider means for preventing those fire hazards. This problem alone probably interests some of the members of several of the different electrical associations, notably the Associated Manufacturers of Electrical Supplies, the Electrical Supply Jobbers' Association and the National Electrical Contractors' Association. The problem may interest some members who are affiliated with the American Institute of Electrical Engineers. It is likely to interest the National Electric Light Association.

If there were a suitably organized clearing house, the Underwriters' Laboratories could refer the problem to that body. Promptly thereafter the proper divisions of the several interested associations would receive advance notice through the clearing house that the problem is in hand. Thus all the interested members of each association will have the opportunity to co-operate in solving the problem.

In innumerable ways such a clearing house will produce harmony, increase effectiveness and prevent wasted or duplicated efforts. R. K. SHEPPARD,

Akron, Ohio. *President Associated Manufacturers of Electrical Supplies.*

Reserve Funds for Central Stations

To the Editor of the ELECTRICAL WORLD:

SIR:—In the issue of the ELECTRICAL WORLD of April 17 appeared an editorial on "Storm Losses," in the last sentence of which was a suggestion concerning a "reserve fund." The writer has been urging on municipalities, legislatures and public utility commissions the necessity of public utilities laying aside a reserve fund for extraordinary expense entailed by circumstances beyond their control and, as a corollary to this, he has claimed that in the making of rates the factor of "risk" should be included, together with other similar factors.

This matter was brought home very strongly to the writer at a state convention some years ago when he brought up this point. Of nearly sixty representatives of public utilities present at this convention, over fifty had suffered losses from fortuitous circumstances for which no provision had been made in either their accounting or their rates. These consisted of destructive fires from the outside, tornadoes, floods, hailstorms and explosions from boilers and bombs. A further investigation conducted by correspondence revealed the fact that over half of the public utilities in the State had been within ten years injured to a greater or lesser extent by these and similar uncontrollable misfortunes, and in nearly every case there had not been sufficient surplus, or at least sufficient free surplus, to take care of the losses occasioned.

Almost every day brings news of similar happenings in every portion of the United States, and I believe that an investigation of this matter from a national standpoint would show that at least 50 per cent of the public utility properties in the United States have been subject to similar losses and were totally unprepared with any "catastrophe reserve" to liquidate such losses.

Under these conditions it would seem that one of the strong pleas to be considered by the public utility commissions of the various states is that the rates be so arranged as to allow for the formation of such a reserve fund, which should be allowed to accumulate until it arrives at a value corresponding to that of a certain proportion of the property destroyable by catastrophes such as the above; this fund to be invested and the interest from it to be applied, directly or indirectly, to the diminution of the rates which created it.

There is nothing inequitable in the formation of a fund in this manner, and the past and present experiences of the public utility business all over the country tend to show that such a fund will be heavily called on within a period of from one to fifteen years.

H. S. COOPER,

Dallas, Tex. *Secretary the Southwestern Electrical and Gas Association.*

Mr. Cotton and Mr. Edwards on Gas-Filled Lamps

To the Editor of the ELECTRICAL WORLD:

SIR:—Referring to the article on the subject of the heating of the 200-watt nitrogen-filled lamp, appearing on page 681 of your issue of March 13, 1915, and to the letter on page 844 of the issue of April 3, 1915, by Mr. Evan J. Edwards, of the National Lamp Works of the General Electric Company, Cleveland, Ohio, in which Mr. Edwards objects to the publication of such an article and illustration in a journal having the standing of the ELECTRICAL WORLD in the electrical field, it is my opinion that any paper that did not open its pages to both sides of any subject would not be worthy of any standing in the art it represents.

Criticism of any worthy device is, I thoroughly believe, of distinct benefit to the device, and any device that cannot withstand criticism should be looked on with suspicion. Electrical inspectors sometimes find that devices that have passed through the Underwriters' Laboratory and which carry the laboratory label of approval prove defective in the field. In such cases criticisms are welcomed, changes are often made, and approval is sometimes even withdrawn—all based on facts discovered outside of the laboratory.

I carried the blackened lamp and receptacle described in your original article to Minneapolis to the inspectors' convention to get facts concerning gas-filled lamp operation other than laboratory tests and measurements.

I claim that the lamp in question was not an unusual

case, and beg to give the following statement of facts, by which, I think, any one in doubt will be convinced. This lamp, with its receptacle, was only one of 407 installed in the factory, and each and every one showed the same trouble—melting of the compound in the receptacle—and every one has since been changed. The installation was in the John Rabb Chair Company of Grand Rapids, a new factory, having 117,884 sq. ft. of floor area. The work was done in conduit, using 3-in. boxes and standard receptacles and gas-filled lamps. The contractor was the Ackerman Electric Company, of 549 Pine Avenue, Grand Rapids. The original receptacles were purchased through the C. J. Litscher Electric Company, which later replaced them with others filled with "nitrogen cement" and equipped with slow-burning wire. The blackened lamps were afterward cleaned and, with the exception of one case, are now in use. The only wrong impression that the article as published could convey was that it was in this installation, rather than in others, that we experienced the trouble of the soldering of the lamp bases to the fittings. The installation referred to was an alternating-current, thirty-cycle, 120-volt service. While I do not know of a case on alternating-current where lamp bases and fittings have been soldered together, I can give to any one interested a list of cases where this trouble has happened on direct-current circuits with lamps of ratings from 200 watts up to 1000 watts, the cause being the high starting current taken by the lamps on direct current. In some recent tests made with the oscillograph the results given in the accompanying table were obtained on direct current.

RESULTS OF OSCILLOGRAPH TESTS

Lamp Size, Watts	Resistance Cold, Ohms	Initial Starting Current, Amp
1500	0.72	166.6
1000	1.08	111.1
700	1.44	83.3
500	2.16	55.5
300	3.60	33.3
200	5.40	22.2

Owing to these excessive initial currents, which may reach more than thirteen times normal current, arcs are caused which will solder the bases to the fittings if the lamp bases make imperfect contact with the fittings, as may be caused by the fittings expanding with the heat or by vibration. I would suggest to any one interested that he try to remove a plug-type fuse on a circuit supplying direct current to a 500-watt lamp. The high initial starting current referred to constitutes a serious objection to the use of the gas-filled lamp. Unless entirely inclosed, the lamp is also very hard on the eyes.

If the gas-filled lamp is perfect and above criticism, the following questions seem pertinent: Why are the manufacturers of these lamps changing the 300-watt lamp from the standard base to the "Mogul" base? Why are the Laboratories requesting that the sealing compound for the heads of screws and nuts in fixtures and fixture parts designed expressly for use with gas-filled lamps shall use a compound which has a high melting point? Why, at the recent meeting of the electrical committee of the National Fire Protective Association, was a report adopted stipulating that gas-filled lamps must not be used in show windows except in approved fixtures, and, further, that fixtures within buildings must be wired with conductors having approved slow-burning insulation or asbestos covering?

There is a furniture exposition building in this city in which fifteen 500-watt lamps are controlled by one switch. This switch breaks the mains and each lamp is on a separate circuit. The mains are three-wire and are fused at 60 amp. This building is now on alternating-current service, but will be transferred to a direct-current source of supply in July for the summer sales. This switch will be operated several times a day for thirty days. Will the main fuses stand the initial starting current of this lamp load, which will be over 800 amp, and is this to be recommended as good construction?

GEORGE COTTON,
Grand Rapids, Mich. *Chief Electrical Inspector.*

To the Editor of the ELECTRICAL WORLD:

SIR:—I hesitate to ask for further space in your valued columns for discussion on a subject which I have already taken up somewhat at length, namely, the installation referred to in Mr. Cotton's letter.

In my letter to you on this subject, which appeared in the April 3 issue of the ELECTRICAL WORLD, there were two principal points that I tried to make—first, that the case cited was unusual; second, that it offered no cause for discrimination against the gas-filled lamp as compared with the vacuum lamp.

I think that we still must conclude that the case referred to is exceptional, for if it were otherwise the article in the March 13 issue would probably never have appeared at all in your columns, now that gas-filled lamps have been in general use throughout the country for a whole year.

The citing of the oscillograph tests is an evidence that my second general idea, mentioned above, was not made clear, for the results shown apply alike to both vacuum and gas-filled lamps. High initial current is not peculiar to the gas-filled lamp. The current in any tungsten-filament lamp is above the normal value for a period of about one-tenth second. This overshooting at the first instant is very severe, but is so brief that it will not blow a fuse or will not trip an ordinary circuit-breaker having a small time element of operation.

The 300-watt lamp was changed from the medium-screw base to the "Mogul" base at the suggestion of a committee of the National Fire Protection Association, the purpose being to limit the wattage of lamps which could be conveniently operated in the existing medium-screw outlets.

EVAN J. EDWARDS,
Cleveland, Ohio. *Engineering Department National Lamp Works of General Electric Company.*

Sensitiveness of Heterodyne Receiver

To the Editor of the ELECTRICAL WORLD:

SIR:—In an article which appeared in the ELECTRICAL WORLD April 24 I discussed the great sensitiveness of the heterodyne radio receiver, comprising a detector the indications of which are proportional to the square of the received current—or, more generally, to a power of the current greater than one. The reason for the great sensitiveness of the heterodyne was there shown to be entirely foreign to the principle of reception by beats.

With regard to this principle itself, permit me to point out that in a note written for the General Electric Company as early as October, 1904, I described a design of a high-frequency machine for wireless telegraphy comprising a number of machines mounted in cascade, as well as the principle of reception of continuous waves founded on the production of beats between two sources slightly different in periodicity.

Villeurbanne, France. MARIUS LATOUR.

ELECTRICAL SAFETY RULES ISSUED

Bureau of Standards Asks Study and Criticism of Its Proposed National Code

The Bureau of Standards is issuing for criticism and study three sections of the proposed national electrical safety code and also a second edition of Circular No. 49, which will constitute Part 4 of the proposed code. As explained by Dr. Edward B. Rosa, chief physicist of the bureau, in articles in the ELECTRICAL WORLD of April 3 and 10, 1915, the proposed code, after criticism, is to be considered at a conference to be held on July 1 and 2 in Washington.

In his introduction to the first three sections Dr. S. W. Stratton, director of the bureau, says in part:

"This electrical safety code runs parallel with the National Electrical Code. More than a year ago the bureau offered to co-operate with the electrical committee in framing safety rules to be incorporated in the present electrical code. But at a conference last November with representatives of the electrical committee and the safety to life committee of the National Fire Protection Association it appeared to be the general desire to keep the safety rules and the fire prevention rules as distinct as possible, and have these two parts of a complete electrical code parallel and separate, instead of interlaced in such a way that they could not be distinguished. This separation simplified their preparation, and to some extent also their administration, although there may be some difference of opinion among inspectors as to the latter.

"An understanding was reached between the representatives of the bureau and the two committees representing the National Fire Protection Association that the bureau should take the responsibility of preparing a National Electrical Safety Code, with the co-operation of the National Fire Protection Association and other organizations, and that such changes as seemed necessary and could properly be made in the fire code to avoid conflicts with the new safety code would be made. In return the bureau was to co-operate with the National Fire Protection Association in the revision of the fire code. In accordance with this understanding a committee was appointed to confer with representatives of the bureau, and together they went through the fire code and made certain recommendations as to changes (which were substantially all adopted at the recent meeting of the electrical committee) and then went through the preliminary draft of the safety code and made many valuable suggestions for its improvement. At a subsequent meeting this committee carefully criticised a later draft of the code, and suggested further improvements.

"The Workmen's Compensation Service Bureau has also given valuable assistance by examining and criticising the early drafts of the code.

"A large number of informal conferences have been held by representatives of the bureau with representatives of State commissions, engineers of operating and manufacturing companies and others. It has been possible to secure approval of nearly all the rules by a very large majority of those participating in the conferences. It is hoped that further informal conferences soon to be held and the final formal conference in Washington will bring about a still greater degree of unanimity respecting the rules.

"Criticism is invited of the proposed rules and suggestions for their improvement, either by way of changes or additions. It is hoped that the statement concerning the plan and scope of the code will be read as well as the notes on the rules. The intent of the rules will thus be better understood, and criticisms will be correspondingly more valuable.

"The thanks of the bureau are extended to the very large number of persons who have so willingly assisted in the discussion and revision of the code. It is hoped that this cordial co-operation may be continued and that the code when finally completed will justify the large amount of time given to it by our conferees."

In a statement outlining the plan and scope of the work the bureau says in part:

"The numbering of the sections and of the rules is on the decimal system. The definitions bear numbers below 100. The rules on stations are divided into nine sections, and ten numbers are reserved for each section, although there are less than ten rules in most of the sections. The rules on overhead and underground lines are numbered from 200 up, the rules on utilization equipment are numbered from 300 up, and the rules on operation are numbered from 400 up. There are 65 rules in Part 1, 49 in Part 2, 63 in Part 3, 116 in Part 4, 293 in all. Each of the four parts is as nearly complete in itself as possible, in order to make it more convenient for use by different classes of users. This plan has made it necessary to duplicate in Part 3 some of the rules of Part 1.

Distinction Between Station and Utilization Equipment

"The rules for stations apply to the electrical supply equipment of indoor and outdoor stations and substations, and also to similar equipment including generators, motors, storage batteries, transformers and lightning arresters when in factories, mercantile establishments or elsewhere, provided they are in separate rooms or inclosures, under the control of properly qualified persons, when such rooms or inclosures are inaccessible to others. Thus, the room or rooms in which the transformers, high-tension switches and distributing switchboard are installed in a factory are regarded as a substation, if under the charge of a qualified person, and subject to the rules for stations. On the other hand, the electrical wiring, motors, switches and other equipment distributed about a factory or other building where employees generally have more or less access to them are regarded as utilization equipment.

"The rules for utilization equipment apply to circuits and apparatus at not over 750 volts. Anything of higher voltage inclosed in rooms not accessible to employees generally will come under the rules for stations. Anything of higher voltage than 750 not so inclosed and accessible to others than properly qualified electrical operators must, in addition to complying with the rules for stations and such of the utilization rules as apply, have all live parts incased in permanently grounded metal conduit or cases, or otherwise guarded, to prevent unsafe approach by any person to the live parts.

Existing Installations

"The rules of Parts 1, 2 and 3 apply, of course, to all new installations, unless modified for special reasons by the proper administrative authority. The question as to what extent they should apply to existing installations has been carefully considered. Obviously, if they did not apply at all to existing installations, they might have very little influence for many years to come. The statement made in regard to this question is in the introduction to the several sections of the rules.

"It is not expected that expensive changes will be made in existing equipment in order to comply with the rules, except in so far as it is necessary to do so to remove a source of serious danger. But in most cases grounding of machine frames, instrument cases or conduits, or erecting of suitable guards (where exposed live parts require it), can be done at substantially the same expense as though it were new equipment, and in all such cases it is expected that it will be done within some reasonable time.

TITLES OF RULES IN PROPOSED ELECTRICAL SAFETY CODE

PART 1
STATIONS

Protective Arrangements of Station:
- General Requirement.
- Illumination.
- Inclosing Walls and Ceilings.
- Floors, Floor Openings, Passageways, Stairs.
- Exits.
- Fire Appliances.

Protective Arrangements of Equipment:
- General Requirement.
- Inspections.
- Irregularly Used Equipment.
- Protective Grounding.
- Working Space about Electrical Equipment.
- Guarding Live Parts.
- Isolating Live Parts by Elevation.
- Identification.

ROTATING EQUIPMENT, STORAGE BATTERIES AND TRANSFORMERS

Rotating Equipment:
- Speed Control and Stopping Devices.
- Deteriorating Agencies.
- Field Break-up Switches.
- Protecting Shaft Ends, Pulleys, Belts and Other Moving Parts.
- Guards for Live Parts.
- Grounding for Non-Current-Carrying Parts.

Storage Batteries:
- Isolation.
- Ventilation.
- Covers.
- Insulating Supports.
- Guarding Live Parts.
- Illumination.
- Acid-Proofing.

Transformers, Reactances, Induction Regulators, Balance Coils and Similar Equipment:
- Oil-Insulated Transformers.
- Current Transformer Secondary Circuits.
- Grounding Low-Voltage Circuits of Power and Instrument Transformers.
- Guarding or Isolating Live Parts.
- Grounding Transformer Cases.

WIRING, AND PROTECTION AND CONTROL EQUIPMENT

Conductors:
- Protection in General.
- Isolation by Elevation.
- Guarding Conductors.
- Guarding in Hazardous Locations.
- Pendants and Portables.
- Temporary Wiring.
- Taping Bare Ends and Joints.

Switches, Fuses, and Other Cutouts; Controllers and Other Control Devices:
- Accessible and Indicating.
- Hazardous Locations.
- Where Switches Are Required.
- Character of Switches to Use.
- Where Automatic Cut-outs Are Required.
- Arrangement of Automatic Cut-outs.
- Suddenly Moving Parts.
- Grounding Non-Current-Carrying Metal Parts.
- Guarding Live Parts of Switches and Automatic Cut-outs.

Switchboards:
- Accessibility and Convenient Control.
- Convenient and Safe Attendance.
- Safe Location.
- Necessary Equipment.
- Arrangement and Identification.
- Illumination.
- Spacings and Barriers Against Short-Circuit.
- Protective Ground.
- Grounding Frames.
- Guarding Live Parts.

Lightning Arresters:
- When Required
- Type and Capacity.
- Disconnecters.
- Location.
- Ground Wires.
- Grounding Frames.
- Guarding Live Parts.

PART 2
LINES

General Requirements:
- Design and Capacity.
- Minimum Requirements.
- Inspections.
- Records.
- Isolation, Guarding, and Accessibility.
- Electrical Protection and Control of Circuits.
- Grounding Circuits and Equipment.
- Identificatcn.

OVERHEAD LINES

Construction Required for Crossings, Conflicting Lines and Lines on the Same Supports:
- Separation of Lines to Avoid Conflict.
- Arrangement of Lines When in Conflict or Carried on the Same Supports.
- Required Grades of Construction.
- Requirements for Construction and Maintenance of Lines Designated by Grades.

Clearance of Conductors at Crossings:
- Conductors Above Railways and Highways.
- Conductors Crossing Others.
- Increase in Clearances Between Conductors for Spans Exceeding 100 Ft.
- Increase in Clearances Between Conductors for Voltages Above 40,000 Volts.

Clearances of Conductors (Other than Crossing Clearances):
- Separation of Line Conductors of Each Voltage Classification.
- Lateral Working Space Between Line Conductors.
- Vertical Clearances between Line Conductors of Different Circuits Operating at Different Voltages.
- Clearances for Suspension Insulators.
- Clearances of Vertical and Lateral Conductors.
- Clearances from Buildings.

Guarding Live and Arcing Parts:
- Switches, Automatic Cut-outs and Lightning Arresters.
- Lamps.
- Insulating or Mechanical Guards for Guy and Span Wires.
- Trolley Contact Conductors.

Supporting Structures:
- Poles or Towers—Clearances and Identification.
- Guys and Anchors.
- Cross-arms.
- Protective Covering or Treatment.
- Climbing Space.
- Branch Connections.
- Transformers, Regulators, Lightning Arresters, Lamps, Lamp Supports and Similar Equipment.

Conductors and Insulators:
- Material and Minimum Size.
- Tie Wires or Fastenings.
- Marking Insulators.

UNDERGROUND LINES

Manholes, Handholes, and Ducts:
- Location.
- Grading.
- Accessibility.
- Mechanical Details.
- Manhole Covers.
- Mechanical Barriers and Guards.
- Material, Size, and Finish of Ducts.
- Installation of Ducts.

Conductors and Equipment:
- Location and Identification of Conductors.
- Mechanical Protection and Support.
- Spacing.
- Electrical Protection of Building Services.
- Multiple Connections.

PART 3
UTILIZATION

Protective Arrangements:
- General Requirement.
- Inspection.
- Grounding.
- Working Space About Electrical Equipment.
- Guarding or Isolating Live Parts.
- In Hazardous Locations.
- Storage Batteries, Transformers and Lightning Arresters.
- Identification.

Conductors:
- Protection in General.
- Isolating or Inclosing.
- Guarding Conductors Over 150 Volts.
- Guarding in Hazardous Locations.
- Portables and Pendants.
- Temporary Wiring.
- Taping Bare Ends and Joints.
- Guarding Service Conduit.

Switches, Fuses and Other Cut-outs, Controllers and Other Control Devices:
- Accessible and Indicating.
- Hazardous Locations.
- Where Switches Are Required.
- Character of Switches to Use.
- Disconnection of Fuses Before Handling.
- Arcing or Suddenly Moving Parts.
- Grounding Non-Current-Carrying Metal Parts.
- Guarding Live Parts of Switches and Automatic Cut-outs.

Switchboards:
- Accessibility and Convenient Control.
- Convenient and Safe Attendance.
- Safe Location.
- Arrangement and Identification.
- Illumination.
- Spacings and Barriers Against Short-Circuit.
- Grounding Frames.
- Guarding Live Parts.

Motors and Motor-Driven Devices:
- Control Devices.
- Hazardous Locations.
- Deteriorating Agencies.
- Guards for Live Parts.
- Grounding for Non-Current-Carrying Parts.
- Protecting Moving Parts.

Arc Welders and Electrical Furnaces:
- Arc Furnaces.
- Grounding.
- Guarding Live Parts.

Lighting Fixtures and Signs:
- Grounding.
- Insulation.
- Exposed Conductors and Live Parts.
- Accessibility and Guarding of Signs.
- Control of Outdoor Signs.
- Connectors of Signs.
- Isolating or Guarding Lamps in Series Circuits.
- Safe Access to Arc Lamps.
- Bridging Devices.

Portable Devices, Cables and Connectors:
- Insulation.
- Grounding.
- Cable Connectors.
- Identified Conductors and Connectors.
- Use of Portables and Pendants.

Electrically Operated Cars, Cranes and Elevators:
- Guarding Live and Moving Parts—General Requirements.
- Grounding Non-Current-Carrying Parts.
- Control of Energy Supply.
- Control of Movement.

Telephones and Other Signal Apparatus on Circuits Exposed at Any Point by Supply Lines:
- Grounding Non-Current-Carrying Parts.
- Guards.
- Insulating Booths.

TITLES OF RULES IN PROPOSED ELECTRICAL SAFETY CODE (Continued)

PART 4

OPERATION OF ELECTRICAL EQUIPMENT AND LINES

Rules for the Employer:
- Organization.
  - Copy of Rules.
  - Organization Diagram.
  - Address List and Emergency Rules.
  - Drilling Employees.
  - Posting Rules and Diagrams Permanently.
  - Qualification of Employees.
  - Chief Operator.
  - Local Foremen.
- Protective Methods and Devices.
  - Attendance.
  - Two Workmen.
  - Uninstructed Workmen and Visitors.
  - Diagrams for Chief Operator.
  - Instructions for Foremen.
  - Protective Devices.
  - Warning and Danger Signs.
  - Accident Reports.

General Rules for the Employee:
- General Precautions.
  - Rules and Emergency Methods.
  - Heed Warnings, Warn Others.
  - Inexperienced or Unfit Employees.
  - Supervision of Workmen.
  - Exercise Care.
  - Live and Arcing Parts.
  - Safety Appliances and Suitable Clothing.
  - Safe Supports and Safety Belts.
  - Repeat Messages.
- General Operation.
  - Duties of Chief Operator.
  - Duties of Foreman.
  - Special Authorization.
  - Restoring Service After Work.
  - Maintaining Service.
  - Tagging Electrical Supply Circuit.
  - Protecting Traffic.
  - Protecting Workmen by Disconnectors.
- Handling Live Equipment and Lines.
  - General Requirements.
  - Voltages Between 750 and 7500.
  - Voltages Above 7500.
  - Working Alone.
  - When to Kill Parts.
  - Opening Circuits and Working from Below.
  - Connecting Wires and Grounds.
  - Never Open Series Circuits.
  - Stringing Wires.
  - Fire Extinguishers.
- Killing Supply Equipment and Lines.
  - Foremen's Requests.
  - Opening Disconnectors and Tagging.
  - Station Protective Grounds.
  - Permission to Work.
  - Foreman's Protective Grounds for Overhead Lines.
  - Proceed with Work.
  - Other Gangs.
  - Reporting Clear.
  - Removal of Tags.
  - Restoring Servic and Filing Tags.
- Killing Moving Parts.
  - Foreman's Requests.
  - Blocking and Tagging.
  - Permission to Work.
  - Other Gangs.
  - Reporting Clear.
  - Removal of Tags.
  - Restoring Service and Filing Tags.
- Making Protective Grounds.
  - Procedure.
  - Ground Connections.
  - Test of Circuit.
  - Completing Grounds.
  - Removing Grounds.

Special Rules for Employees:
- Supply Station and Switchboard Operation.
  - Care About Machines.
  - Care About Live or Moving Parts.
  - Handling Fuses or Brushes.
  - Battery Rooms.
  - Elevated Positions.
  - Handling Switchboard Equipment.
  - Report Circuit Troubles to Chief Operator.
  - Report Defects.
- Overhead-Line Operation.
  - Test Poles Before Climbing.
  - Use Pole Steps.
  - Care About Live Parts.
  - When Touching Live Parts.
  - Protecting Traffic.
  - Stringing Lines.
  - Reporting Defects.
- Underground Operation.
  - Guarding Manholes, Handholes and Street Openings.
  - Test for Gas.
  - Watchman at Surface of Manholes.
  - Avoid Flames.
  - Pulling Cables.
  - Testing and Splicing Live Cable.
  - Report Defects.
- Series Lamp Operation.
  - Treat as Alive.
  - Handling Series Lamps.
  - Bridge Series Lamps.
  - Testing Series Lamp Circuits.
  - Periodically Disconnected Circuits.
  - Report Defects.
- Meter Operation.
  - Taped Joints.
  - Care About Live Parts.
  - Open Circuits at Switches.
  - Special Tools.
  - Report Defects.
- Testing Operations.
  - Authorization.
  - Check All Conditions.
  - Local Foremen.
  - Warnings and Barriers.
  - Two Men.
  - Report Defects.
- Signal Line Operation.
  - Official in Charge of Operation.
  - Before Climbing Poles.
  - Approaching Supply Lines.
  - Touching Equipment.
  - Stringing Wires.
  - Report Dangerous Conditions.
- Tunnel and Subway Operation.
  - Live Electrical Parts.
  - Standing on Ground.
  - Carrying Tools.
  - Repairing Live Parts.
  - Handling Portable Devices.
  - Fuses and Switches.
  - Injuring Cables and Wires.
  - Temporary Circuits.
  - General Precautions.
  - Report Dangerous Conditions.

"If the state commissions and city administrative officers can provide intelligent and thoroughly competent inspectors, so that their inspections will have to some extent an educational value, the administration of the rules ought to be relatively simple. When force has to be applied it can be done far more easily if the administration of the rules is intelligent and reasonable and compliance is generally a willing one. It is hoped that such intelligent and competent inspection may be secured, and the bureau will do all it can to assist commissions and municipalities who wish to give this kind of inspection.

"Another important question in the administration of the rules is that of uniform interpretation by the people who are expected to comply with the rules and by the inspectors and others who administer them. It has been suggested to the bureau that a textbook on safe construction and operation is much more needed than a set of rules. It is hoped that the notes to the rules, as they will be expanded in the later publication, will in connection with the rules fulfil to some extent the function of such a textbook. We shall be greatly pleased to receive suggestions as to what additional material should be put into the notes.

"Many of the rules are put in the mandatory form by the use of 'shall'; others are intended as strong recommendations, 'should' being used to indicate that fact. 'Should' is often used where it would be proper to require a certain thing of some companies but not of all. It was thought far better to make the rules reasonably complete, with some of them not mandatory, than to cut out all that could not properly be made mandatory generally.

"It is the hope of the bureau that when the code has been revised once more, approved by the Washington conference and republished it may be adopted very generally and with the minimum of changes by individual states or cities. It is suggested, however, that the first year may be made a trial year, during which the companies, inspectors and commissions may become thoroughly acquainted with its practical operation, and that it be not enforced in any strict sense until after the first year. We believe that if the utilities and other companies coming under it are invited to 'try out' the code, to comply as well as they can, to report wherein it is not satisfactory and to assist in the effort to remedy its defects by revision at the end of the first year, far better results will be attained in the end than if it is made compulsory at the start."

Operation and Maintenance of Equipment and Lines

In the introduction to the rules for the operation and maintenance of electrical equipment and lines, Dr. Stratton says:

"The growth of compensation laws has emphasized the urgent necessity for state commissions to adopt safety rules for the electrical industry as well as for other industries, and the demand for an adequate standard set of such rules has now become general.

"After extended comparisons and analyses of existing

sets of rules, and aided by the suggestion of commissions, company officials and workmen, a code of safety rules was drawn up and offered for criticism, discussion and, in so far as was found desirable, for adoption. This set of rules was published on Aug. 1, 1914, as Bureau Circular No. 49, and about 2000 copies were distributed with a request for comment and criticism. Several hundred letters were received in response to this request, and the many careful criticisms received were utilized in a thorough revision of the rules.

"In the meantime the accident committee of the National Electric Light Association had the rules of Circular No. 49 reprinted with some modifications of its own and sent them out for criticism to a considerable number of companies, receiving a large number of careful letters in reply. The committee then met the representatives of the bureau, and together they made a final revision which is presented in the second edition of Circular No. 49.

"The thanks of the bureau are presented to all those who have assisted in the work of revision, and particularly to the N. E. L. A. and its accident committee for its valuable co-operation."

The rules apply to the operation of, and work on or about, power and signal lines, the electrical equipment of central stations, substations, private plants, and on electrical tests and tunnel, subway or similar underground work. The plan and scope of these rules are discussed by the bureau in part as follows:

"The rules for the employer are subdivided for convenience into two groups. The first covers matters relating to the organization, such as the issuance of rules, diagrams and emergency instructions to employees, determination of the qualifications of employees by suitable examinations, and division of responsibility among employees. The second treats of the portable safeguards which the employer should provide, the operating precautions which he should enforce, and the uniform reporting of accidents on which the ultimate analysis and elimination of electrical accident causes must depend, which latter is so inadequately handled by most states and companies to-day. The employer is required to enforce the observance of the safety rules issued to the employees.

"The general rules for the employees are subdivided into six groups. The first enumerates those general precautions the necessity for which seems obvious but the non-compliance with which is nevertheless responsible for many injuries. The second presents general operating rules, defining the duties and relations of those employees who direct others and the operating methods by which safety is secured. The third group prescribes the precautions for handling live parts under varying conditions of voltage and locations. The fourth and fifth deal with the procedures for assuring the continued safety of work about normally live or moving parts, respectively, by avoiding all possible sources of misunderstanding when killing such parts. The sixth group covers in some detail the procedure for making grounds on equipment or lines for the protection of workmen.

"Special rules for employees are grouped into separate headings, each covering those peculiar to some special class of electrical work. Each class of worker is directed to familiarize himself also with the general rules which apply to all classes of electrical employment. By this arrangement a more adequate treatment has been realized without unnecessary repetition.

"While all the rules find application in the larger industrial or private plants and in moderate-sized utilities, some do not apply (or apply less fully) to the smaller. It has seemed unwise, however, to attempt to restrict the scope of the rules to those which are applicable to all organizations or to all classes of electrical work."

The full code of rules will constitute a complete code of safety rules for electrical practice, except that the rules for signal-line operation have not been brought together as compactly as could be desired. This defect will be remedied in the near future by a fuller treatment in a separate section of operating rules for signal linemen working on telephone and telegraph circuits for public use.

Engineers on New York Constitutional Revision

A committee of engineers representing national and local professional engineering societies has sent a letter to the New York State Constitutional Convention, which is now in session, suggesting that the technical developments of the period which has intervened since the present constitution was adopted have introduced into government large problems in connection with public works and utilities requiring legislation which should be based on constitutional provisions.

Among the specific recommendations of the committee is the following:

"A department of public utilities should be created to be headed by five commissioners appointed by the Governor, each to have a ten-year term of office so arranged that a vacancy will be created every two years. Commissioners should be eligible for reappointment. At least two commissioners should be professional engineers in good standing in the profession. Each appointee should have had experience in connection with public utilities which would fit him for the duties of the office. At least two and not more than three commissioners should be residents of New York City. This department should regulate and supervise all common carriers, all water-supply, irrigation, drainage, gas, power, lighting, heating, intelligence-transmitting and other public utility corporations operating within the limits of New York State, including similar activities on the part of any other State department or political subdivision of the State. This department should be divided into such bureaus as may be essential. Each engineering bureau should be administered by a chief engineer selected with sole regard to his peculiar fitness for the office, and he should have power, subject to the approval of the commissioners, to select and appoint such division engineers as are essential to the proper conduct of his office."

The members of the committee are: Messrs. Arthur S. Tuttle, Henry W. Hodge and Alfred D. Flinn for the American Society of Civil Engineers; Gano Dunn, Ralph D. Mershon and William McClellan for the American Institute of Electrical Engineers; Arthur M. Greene, Jr., Charles Whiting Baker and E. Gybbon Spilsbury for the American Society of Mechanical Engineers; Ralph D. Mershon, Charles W. Leavitt, Jr., and Alten S. Miller for the American Institute of Consulting Engineers; Alfred D. Flinn, George W. Tillson and Ernest P. Goodrich for the Municipal Engineers of the City of New York, and Nelson P. Lewis, William W. Brush and Jacob S. Langthorn for the Brooklyn Engineers' Club.

Mr. Arthur S. Tuttle is chairman of the committee, Mr. Calvin W. Rice secretary and Mr. E. J. Mehren assistant secretary. A committee of the American Institute of Mining Engineers, consisting of Messrs. W. L. Saunders, Benjamin B. Lawrence and J. Parke Channing, collaborated in the preparation of the "principles" and "recommendations." Individually the members of this committee approved them. Pending consideration by the governors of the institute, the committee is unable to subscribe to them officially.

Municipal-Utility Problem at Emporia, Kan.

A Central Station Built by Private Capital, Then Owned and Operated by the City, and Now Leased to a Progressive Syndicate

WHEN municipal and private ownership are mentioned in the same sentence every public utility man within earshot immediately becomes interested. He listens expectantly, confident that he will soon hear one or the other plan, together with all its adherents, roundly denounced. It is the exception rather than the rule for a speaker or writer touching on the subject to be anything but radical. It is generally conceded, therefore, that adherents of these opposing principles must be at swords' points, and the idea of representatives of municipal ownership and private operation working together in a common cause may at first be surprising. But a combination of municipal and private ownership has been effected in the electric utility at Emporia, Kan., which, according to the statements of all concerned after four years' trial, seems to be proceeding on a satisfactory and profitable basis. A history of the electric service in that Kansas community discloses many things of interest.

History of the Emporia Plant

The first electric-light plant built in Emporia was financed by local business men in 1886. The plant was owned and operated as a commercial enterprise until 1903, at which time it was purchased by the city. Many changes had been made in the mechanical plant equipment during the seventeen-year period of private ownership, and still further additions and changes were necessary during the period of municipal ownership and operation which followed between the years 1903 and 1911. In April, 1911, the boiler room at the station contained four hand-fired 150-hp fire-tube boilers and some pumps of inadequate rating, while in the engine room there were two engine-driven generators rated at 360 kw and 150 kw respectively.

To the distribution system existing in 1911 about 750 customers were connected. Three hundred and fifty of these received energy through meters, but the remaining 400 paid a flat rate and wasted electricity as they saw fit. The rates for electricity at that time ranged downward on a sliding scale from a maximum of 10 cents per kw-hr. The minimum bill was $1 a month. As is the case with many another enterprise, the need for extension had grown much more rapidly than had the funds available for making extensions. Without bonding the municipality beyond the point considered practicable the city found itself unable to make the improvements which, to produce good service, were demanded. There was at that time no street-railway system in Emporia, but the people felt that such transportation was necessary, so foreign capital had to be solicited.

Leased at 5 per Cent of Appraised Value

In April, 1911, after a board of appraisers had established the value of the plant and entire system at $68,000, it was leased to the utility-operating syndicate headed by Mr. Albert Emanuel, of Dayton, Ohio. Mr. M. Dunsworth, superintendent for the municipal enterprise, was retained and made secretary and general manager of the new company. According to the terms of the contract between the city and the operating company the rates for electric service are to be the same as those that prevailed under the municipal régime. It is provided, however, that at the termination of each five-year period during the twenty-year life of the lease there shall be an opportunity of adjusting rates to meet the wishes of both the city and the Emanuel syndicate. During the life of the lease the operating company agrees to pay the city 5 per cent annually on the

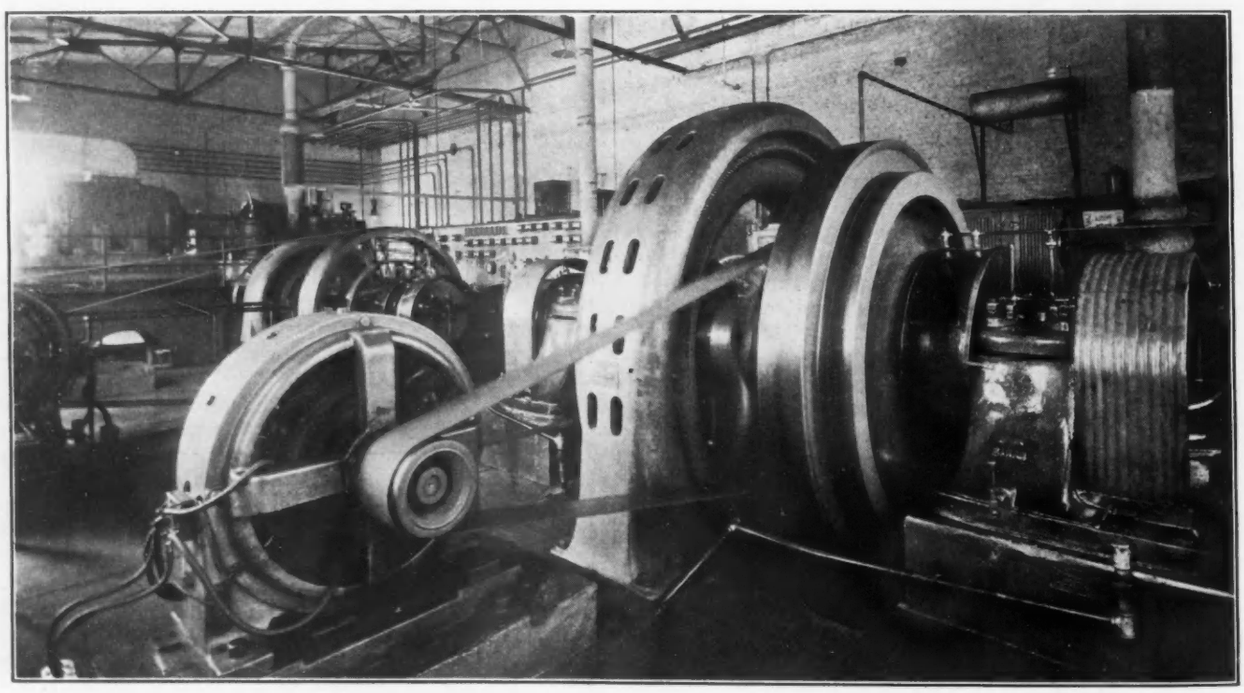


FIG. 1—INTERIOR OF POWER STATION, EMPORIA, KAN.

appraised value of the original system, $68,000. The operating company further agrees to make needed plant improvements and to build a street-car system. At the expiration of the lease, it is agreed, a board of arbitration shall determine what has been the increased value of the system, or to what extent the city is indebted to the operating company for capital expenditures.

Approximately four years have elapsed since the agreement was signed, and in that time many changes have been brought about. At the power house two 300-hp Babcock & Wilcox water-tube boilers, together with larger feed pumps and forced-draft apparatus, have been installed. A 500-kw Allis-Chalmers condensing steam turbine has been added to the generating equipment and a spray-system cooling pond has been put into service to conserve water. The power-station building itself has been overhauled and made fireproof by removing woodwork and adding steel. The walls have been raised and all interior wiring inclosed in iron conduit. The switchboard has been enlarged and rebuilt. In round figures $70,000 has been spent in rehabilitating the station.

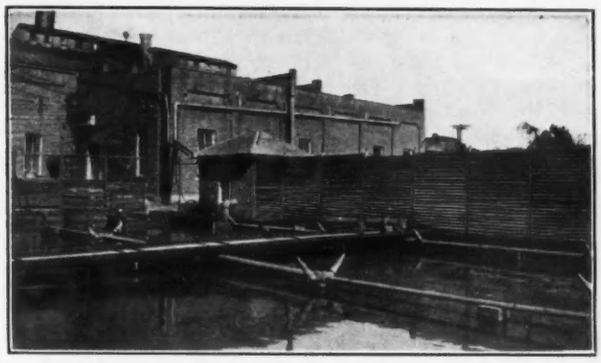


FIG. 2—SPRAY SYSTEM FOR COOLING CONDENSING WATER AT EMPORIA PLANT

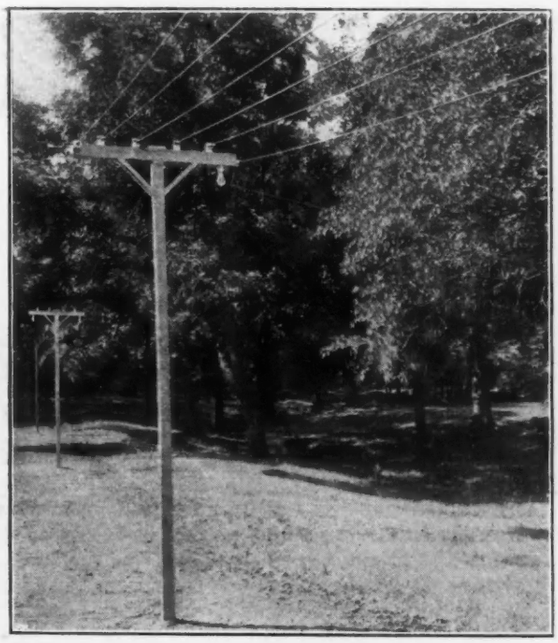


FIG. 3—INEXPENSIVE LIGHTING AND WIRING IN PARK

Meanwhile the new-business department of the company has been quite successful. Three house-wiring campaigns have been conducted in co-operation with the electrical contractors in the city, with the result that the company now has 1550 customers as against 750 four years ago. The industrial-motor load connected to the company's plant has grown from almost nothing to about 700 hp. A part of this load, 200 hp, is obtained from the city water-pumping station. Seven blocks of white-way lighting has been placed in operation on the main business street. About 800 electric irons have been sold and distributed as premiums in the house-wiring campaigns, and the company moved its office to a new and convenient location.

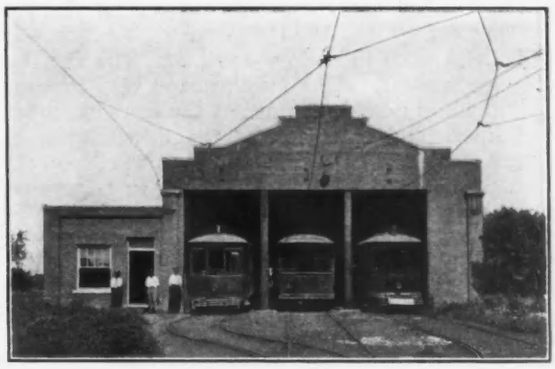


FIG. 4—CARHOUSE BUILT BY EMPORIA RAILWAY & LIGHT COMPANY

The street railway promised the city has been built, 5.125 miles of track being now in service. The single-end pay-as-you-enter cars used are operated by one man. Each car is equipped with two 40-hp motors taking energy from the company's buses through a rotary converter. Four cars, which operate on regular schedule, pull trailers during the rush season when the townspeople are visiting the nightly entertainments at the amusement park constructed and lighted by the utility-operating company.

Building of the car line encouraged extensive rather than intensive growth of the resident districts, and consequently many fine homes have been built and are being built in the outskirts of the city. Distribution circuits of the electric-service company have had to follow the trend of the community and many extensions have been made. The sum expended in extending the distribution system is about $18,000. Improvements have also been made on the original system taken over in 1911.

Besides making these improvements in the physical plant equipment, the Emporia Railway & Light Company has given its patrons good electric service, according to the opinions of citizens who have expressed themselves. Mr. William Allen White, the author, who is the editor of the Emporia *Gazette*, declares that the people of the city are well satisfied with the present arrangement, and he, although an advocate of municipal ownership, acknowledges the wisdom of this practical solution of the utility problem at Emporia. "When the first five-year period is finished," says Mr. White, who is a leader of local public opinion, "it is assured that no political demagogue will be elected to fill a city office on false promises of electric-rate reductions. The adjustment of rates will be a business proposition handled without prejudice."

Summing up, the history of the Emporia plant during its first five-year period of leased operation—now nearly completed—shows extensive rehabilitations to its generating plant, the extension of electric service to double the former number of customers, the inauguration of motor service to factories, and the construction of a street-railway system.

American Electrochemical Society Meeting

Atlantic City-Philadelphia Convention Provides an Interesting Program, and Animated Discussions Are Held

THE twenty-seventh general meeting of the American Electrochemical Society was held in Atlantic City on April 22 and 23, and concluded in Philadelphia on Saturday, April 24. The registered attendance was 130. The meeting was very enjoyable, the outstanding notable feature of the convention being the liveliness and extension of the discussions. The meetings were held in Atlantic City at the Hotel Chalfonte and in Philadelphia at the Harrison Laboratories of Chemistry of the University of Pennsylvania. On Saturday the society was entertained at lunch by the university in Houston Hall.

At the annual business meeting on April 22 the election of new officers was announced as follows: Mr. Lawrence Addicks, of Douglas, Ariz., is the new president; Messrs. L. E. Saunders, J. A. Mathews and L. Kahlenberg were elected vice-presidents, and Messrs. L. D. Vorce, William Acheson Smith and W. H. Walker managers; Mr. P. G. Salom was re-elected treasurer, and Dr. Joseph W. Richards, of Lehigh University, was re-elected secretary.

There were two special lectures, both exceedingly interesting and enjoyable. On the evening of Thursday Prof. W. S. Franklin lectured on mechanical analogies with electromagnetic phenomena in alternating-current engineering, pointing out especially the analogy between inductance in electromagnetic phenomena and inertia in mechanics and the analogy between a condenser and an elastic medium. The explanations were illustrated by a series of exceedingly clever experiments.

On Saturday afternoon Dr. Edgar F. Smith, provost of the University of Pennsylvania, delivered an equally enjoyable lecture on the connection between electrochemistry and the University of Pennsylvania. He spoke of the early work of Robert Have and of his own and his many co-workers' work on electro-analysis, describing at the conclusion a new separation of cobalt and nickel.

Presidential Address

The retiring president, Mr. F. Austin Lidbury, of Niagara Falls, N. Y., dealt in his presidential address with "The American Electrochemical Society in Its External Relations." He discussed the obligation of a national engineering society to represent its membership, and what it stands for in the larger affairs of life. As to current tendencies in government the engineer has been worrying for a long time. The intelligence of government of a democracy depends upon the co-operation of the intelligent elements, and to a large extent the responsibility rests on those professions which claim to embody the application of intelligence to industrial operations. A well-defined portion of this responsibility rests upon the unusually representative American Electrochemical Society.

A sin of omission of this, in common with many technical bodies equally interested in the matter, has been the inaction in regard to legislation concerning water-power, and the electrochemical industry is already paying the penalty in the way of increasing scarcity of power and rising prices in the Niagara district.

The country is now governed more and more by commissions and bureaus. The scientific bureaus of the government are doing constructive work, and the national engineering societies should help them by suggestions but also by checking any tendency toward unnecessary or positively objectionable work or publications.

Co-operation of the American Electrochemical Society with other national engineering societies should be not only willingly given but sought after. In this respect the local sections can do so much that the encouragement of local sections is the readiest means of fostering a healthy internal and external development.

Fibrox

The first formal paper of the convention presented after the presidential address dealt with a new and very interesting heat-insulating material called "fibrox," the author being Dr. E. Weintraub, of the General Electric Company of Lynn, Mass. This material has chemically the constitution of silicon oxycarbide, and its most remarkable feature is its fibrous structure. The diameter of the fibers is of the order of 0.6 micron to 0.3 micron. That is much smaller than the diameter of thin hair. Fibrox is a soft, resilient fibrous material and can be cut into plates, sheets and rings which are self-supporting.

The apparent density of the material, while varying with the circumstances, is usually between 0.0025 and 0.0030. In other words, it weighs only from about 2.5 grams to 3 grams per liter. As it consists of from 99.5 to 99.9 per cent of air (in the pores) and only from 0.5 to 0.1 per cent of solid material, it is the very best heat insulator known, and in view of this it is very peculiar that it is a relatively good electrical conductor with a conductivity comparable to that of electrolytic solutions.

Samples of fibrox were exhibited, and an extended discussion followed in which Messrs. Tone, Arthur, Hitchcock, Franklin, Northrup, Baekeland, Taylor, Mott, Hering, Richards, Saunders, Frary and Weintraub participated.

Thermal Conductivity of Refractories

In a paper on thermal conductivity of refractories Prof. Boyd Dudley, Jr., of the Pennsylvania State College, described a new method for determining the heat conductivity of refractory brick under furnace conditions resembling those in practice. The measurement is carried out with a special coke-fired furnace of which the roof and three walls are permanent and the fourth wall is built up of the brick to be tested. Temperature measurements are made at various points in the brick and by means of a special calorimeter. The rate of heat flowing through the wall is measured. The apparatus was applied by the author to detailed tests of first quality fire-clay brick, silica brick with clay bond, silica brick with lime bond, and magnesite brick. The results were given in tables and diagrams.

The paper was discussed at considerable length by Messrs. Hering, Richards, Schluederberg, Hitchcock, Addicks, Chapin, Northrup and Frary.

Reaction Between Graphite and Magnesia

A paper by Profs. O. L. Kowalke and D. S. Grenfell, of the University of Wisconsin, dealt with the temperature of reaction between Acheson graphite and magnesia. The authors conclude that this reaction commences slowly at about 1950 deg. C. and becomes very violent at temperatures above 2030 deg. C.

The paper was discussed by Messrs. Bennett, North-

rup, Hinckley, FitzGerald, Whitney, Richards, Mott, Hitchcock, Frary and Saunders.

Colloidal Chemistry

The first two papers of the Friday morning session were of a highly theoretical nature and dealt with subjects of colloidal chemistry, the author of both papers being Prof. Wilder D. Bancroft, of Cornell University. In the first paper were discussed the neutralization of adsorbed ions, and in the second the coagulation of albumin by electrolytes.

The papers elicited a very lively discussion on the nature of adsorption and on colloidal chemistry in general and its relation to biology and electrochemistry, in which Messrs. Whitney, Frary, Cox, Lidbury, Franklin, Mott, Williamson and Taylor participated.

Thermocouples

A paper by Mr. T. S. Fuller, of the Research Laboratory of the General Electric Company, Schenectady, dealt with the thermo-electromotive force of certain iron alloys. The available literature on the thermo emf of base metal alloys is rather scarce. The author described the method of his measurements and gave the results obtained for iron-nickel, iron-chromium, iron-cobalt, iron-nickel-chromium and iron-nickel-manganese alloys. The results were given in tables and diagrams.

The paper was discussed by Messrs. Fink, Mott, Gillett, Jacob, Whitney, Richards, Hinckley, Ruder and Fuller.

Copper Leaching and Electrolysis

The last subject on the program of the Friday morning session was the discussion of the problem of leaching low-grade copper ores with subsequent electrolytic precipitation of the copper. An extended discussion of the subject had recently been held at a joint meeting of the New York sections of the American Electrochemical Society and the American Institute of Mining Engineers, in which Messrs. L. D. Ricketts, Utley Wedge, E. A. Cappelen Smith, George D. Van Arsdale, Raymond F. Bacon, Frederick J. Pope, J. Park Channing and R. C. Canby had participated, and a summary of this discussion was presented at Atlantic City by President-elect Lawrence Addicks, who added some further comments of his own to the subject. Mr. Van Arsdale, Mr. J. V. N. Dorr and Dr. J. W. Richards also added interesting notes to the discussion of the subject.

Electrolytic Preparation of Magnesium

A paper by Profs. Francis C. Frary and Harry C. Berman, of the University of Minnesota, dealt with one difficulty met with in the electrolysis of molten magnesium potassium chloride. This is the formation after a time of numerous dark spots which are concluded by the authors to be magnesium suboxide. The present investigation shows that this suboxide forms only when magnesium oxide is present and that high temperature facilitates its formation. It is necessary to prevent the formation of magnesium oxide during the preparation of electrolyte and during the actual electrolysis.

The paper was discussed by Messrs. Lidbury, Richards, Taylor, Vorce and Bennett.

Calorizing Metals

A paper by Mr. W. E. Ruder, of the Research Laboratory of the General Electric Company, Schenectady, N. Y., described the process of "calorizing," which is intended for the protection of metals at high temperatures and which consists in producing a rich aluminum alloy upon the surface of the metal to be protected. The process as used at present consists briefly in packing the pieces to be protected in a mixture containing powdered aluminum and heating to various temperatures varying from 700 deg. to 900 deg. C. Perhaps the most important application of the process is the treatment of iron to withstand temperatures below 1000 deg. C. indefinitely. The process is finding considerable application in furnace parts, pyrometer tubes, annealing boxes, combustion tubes, etc. The process is also applied to the protection of copper and nickel.

The paper was discussed by Messrs. Addicks, Hinckley, FitzGerald, Mott, Richards and Vorce.

Fixation of Atmospheric Nitrogen

The conclusion of the Friday afternoon session was a general discussion of the possibilities of the fixation of atmospheric nitrogen in this country. The subject matter of two papers recently presented at a joint meeting of the American Institute of Electrical Engineers and of the New York Section of the American Electrochemical Society was first summarized, the first paper, by Mr. L. L. Summers, of Chicago, giving a very good broad review of the whole subject, the second paper, by Mr. F. S. Washburn, dealing in detail with the calcium-cyanamide process. A "polemical note" was read by Mr. S. Peacock, who maintained that a commercially successful process must yield as the first product potassium nitrate or ammonium nitrate or primary ammonium phosphate, at a factory cost not materially exceeding 5 cents per pound of combined nitrogen figured as ammonia.

A very extended discussion followed, in which Mr. Summers defended the other processes against the claims of the cyanamide process, and Dr. Baekeland discussed the commercial situation in Europe and in this country. Messrs. Bennett, Fink, J. E. Johnson, Jr., Franklin, Frary, Whitney, Richards, Hitchcock and Lidbury participated in the further discussion, which dealt to a large extent with the future of ammonia production from by-product coke ovens and from other sources. The question as to what determines the price of ammonia was dealt with at some length.

Joint Meeting with the Illuminating Engineering Society

The Saturday morning session was held jointly with the Illuminating Engineering Society at the University of Pennsylvania.

A paper was first presented by Dr. Herbert E. Ives on "Illuminating Engineering and Ideal Light." The speaker emphasized that the illuminating engineer ought to rewrite the specifications for the light-producing engineer. The ideal light, according to the viewpoint of the illuminating engineer, is not a brilliant point but a surface of low intrinsic brilliancy, perhaps a surface of a window square.

Dr. Ives pointed out that the vacuum-type tungsten lamp is 300 times as bright as the brightest object by day, namely, a white surface in the sun. The nitrogen-filled tungsten lamp is 1000 times as bright, and it

TOTAL LUMINOUS EFFICIENCY OF VARIOUS LIGHT SOURCES

Light Source	Luminous Efficiency of the Radiation, per Cent	Total Luminous Efficiency, per Cent
4-watt carbon lamp	0.45	0.42
Vacuum tungsten lamp at 1.25 watts per candle	1.65	1.3
Nitrogen-filled lamp at 0.70 watt per candle	2.93	2.4
Welsbach mantle, 0.75 per cent "Ceria"	1.2	0.19
Open-flame gas burner	0.19	0.036
Yellow flame	....	7.2

becomes necessary to employ reflecting and diffusing media. What is required is a surface source of an intrinsic brilliancy of not over 0.001 cp per sq. cm. A true luminous paint which could be easily excited at

will would meet this idea. A low intrinsic brilliancy is in great demand.

The efficiencies of modern illuminants are surprisingly low. If we figure from coal, 1 per cent is the best figure obtainable to-day. Light is actually only a small by-product.

At the conclusion of his lecture Dr. Ives gave the figures printed on page 1109 of recent measurements made by him of total luminous efficiency based on 50 cp per watt as the mechanical equivalent of light.

The paper was discussed by Dr. Hering, Mr. Addicks and Dr. Ives.

A paper by Mr. W. C. Moore, of the National Carbon Company, on "Chemistry in the Development and Operation of Flaming-Arc Carbons," which had already been presented at the joint meeting of the New York sections of the American Electrochemical Society and the Illuminating Engineering Society, was discussed by Messrs. Mott, Barrows, Franklin, Hering, Darrah, Miller, Fink, Moon and Richards.

A paper was presented by Mr. R. E. Harrington, of the Edison Lamp Works, Harrison, N. J., on the lighting of electrolytic tank rooms by means of tungsten lamps. The author concluded that correct lighting increases safety and production, two factors of vital importance. The correct lighting may be secured by the proper selection of lamps and reflectors, the porcelain enamel reflector being given the preference. Of the various methods of lighting commonly employed, the system of general illumination is most universally adaptable, although localized general lighting should be used where tanks are covered by hoods. Considering the question from a cost standpoint, experience has shown that in many cases the cost of proper lighting with the modern lamps is often less than improper lighting with the older types of lamps.

The paper was discussed by Messrs. Lidbury, Addicks, Stephens, Barrows, Franklin, Mott, Harrington and Hogaboom. The question of lighting of plating rooms brought out a discussion of the best methods of producing artificial light for the correct matching of colors.

Joint Meeting with American Electroplaters' Society

The concluding session of Saturday afternoon was held jointly with the American Electroplaters' Society. After Dr. E. F. Smith had concluded his interesting address on electro-analysis, Prof. O. P. Watts, of the University of Wisconsin, presented a paper in which he pointed out that for years the electric current has been used in plating establishments, not only for the plating proper but also for the preliminary cleaning. The author discussed the question whether it was possible to carry out the cleaning and the plating in the same bath.

The paper was discussed by Messrs. Frary, Schluederberg, Addicks, Bennett, Hogaboom, Proctor, Benoliel and Frary.

In a paper on the electrodeposition of lead, Messrs. Frank C. Mathers and Asa McKinney, of Indiana University, stated that smooth solid lead deposits can be obtained from lead nitrate solutions containing free acetic acid, and as additional agent a residue from the commercial extraction of Curaçao aloes in the manufacture of aloin.

The paper was discussed by Messrs. Richards, Bancroft, Lidbury, Bennett and Miller.

In a paper dealing with electroplating with cobalt, Messrs. Herbert T. Kalmus, C. H. Harper and W. L. Savell, of Queen's University, described a process for plating with cobalt which was not only successful in the laboratory but was equally successful on a commercial scale.

The paper was discussed by Messrs. Miller, Bennett, Fink, Watts, Hogaboom, Blum, Chapin, Lidbury, Lukens, Richards and Fink. It was acknowledged that cobalt plating has certain distinct advantages over nickel plating. The color is better, and, above all, the time of plating can be very much reduced. But the electroplaters present insisted that before cobalt plating can become general the price of cobalt must be reduced materially.

The next meeting of the American Electrochemical Society will be held in San Francisco on Sept. 16, 17 and 18, 1915, and joint sessions will be arranged with the American Institute of Mining Engineers and the American Institute of Electrical Engineers.

Changes in Details of Gas-Filled Lamps

Manufacturers of gas-filled tungsten-filament lamps for multiple circuits have announced the adoption of a new standard of construction expected to eliminate very largely certain defects which developed in the earlier types of these lamps.

Perhaps the most important change consists of the adoption of a bulb which incorporates the good features of both the round and straight-side types used heretofore, together with long narrow necks inclosed by mica disks, thereby keeping the upper and base portions of the lamp relatively cool.

The multiple gas-filled lamps now on the market are of the 100, 200, 300, 400, 500, 750 and 1000-watt sizes in the standard voltage range, 105 volts to 125 volts. In each case the dimensions of the new standard line of lamps are the same as, or slightly smaller than, those used heretofore, and therefore all of the fixtures and equipment now used with these lamps can be used without change with the lamps of the new bulb designs.

The 300-watt lamp will hereafter be regularly made with the "Mogul" screw base. The Underwriters have recommended that the medium-screw socket should not be used for lamps above 200 watts. This change of lamp construction will assist in putting the new ruling into effect. The light center length of the 300-watt lamp has been made the same as that of the 400-watt and 500-watt sizes, so that one type of fixtures can be used with all three sizes. The 750-watt and 1000-watt lamps also have the same physical dimensions, which permits one style of fixture to accommodate either.

Perhaps the most important feature in connection with the new lines of lamps is that lamps of 200 watts or over are designed to operate only in a vertical position, tip downward. This construction permits a material improvement in the quality of the lamp over what it would be possible to attain if a design were to be attempted which would permit them to be operated in any position.

One characteristic of the multiple gas-filled lamp of 200 watts and above, as at present constructed, is that it will operate most satisfactorily in a vertical, tip-downward position, but satisfactory operation can be expected of these lamps when removed from the vertical by not more than 25 deg. when used in a tip-downward position. Lamps for tip-upward use are being built of special design by the manufacturers.

Particular attention is being devoted to the photometering and rating of these lamps by the manufacturers, who are using as a basis of design data based on specific luminous output and comparative filament temperatures. Whether or not the mean horizontal candlepower rating now used will prove sufficiently indicative of the luminous output of such lamps to warrant its continued use, or whether the mean spherical basis of rating will be employed, is still doubtful.

Analysis of Unbalanced Three-Phase Systems

Reactions in Generator Carrying an Unbalanced Load Treated as Equivalent to Two Balanced Loads

BY L. G. STOKVIS

THREE-PHASE generators frequently carry unbalanced loads. Conditions causing unbalancing are unequally distributed lamps or other single-phase apparatus, transformers connected for three-phase two-phase transformation, short-circuits (partial or complete) on only one or two phases, etc.

Three important effects arise when the currents in the three phases are unbalanced, namely, (1) the terminal voltages of the three phases become unequal in value and are not 120 deg. apart in phase, (2) a double-frequency alternating current is induced in the field circuit, and (3) a triple-frequency voltage is induced in the armature circuits. This triple-frequency voltage is due to a magnetic field which rotates at three times synchronous speed with respect to the armature. The voltages induced by this field in the three phases are therefore 120 deg. apart in phase, and this triple-frequency component consequently appears in the line voltage as well as in the phase voltage.

It is the purpose of this article to analyze these reactions in detail, and to give a method of predetermining their quantitative values under any condition of unbalancing. A connection is also described by means of which the double-frequency current induced in the field circuit may be rendered harmless.

Synchronous and Inverse Currents.—The method of treating an unbalanced three-phase generator herein described is based upon the principle that the currents in the three phases of such a generator are identical both in magnitude and phase relation with the total currents per phase delivered by two generators connected in parallel and delivering balanced currents but with the terminals of two phases of one of these generators reversed. That is, a generator delivering the three unbalanced currents I_1, I_2 and I_3 (see Fig. 1) is equivalent to the two generators in parallel in Fig. 2 delivering the same total currents, the currents I_s delivered by the three phases of generator A being exactly equal and differing in phase by 120 deg. and the currents I_i delivered by generator B likewise being equal and differing in phase by 120 deg. but with the sequence of phases in generator B opposite to the sequence of phases in generator A.

The proof of this relation and the determination of the values of the currents I_s and I_i and their phase relations in terms of the three currents I_1, I_2 and I_3 is as follows: Referring to Fig. 1, let I_1 be the larger and I_2 the smaller of the three unbalanced currents, and let γ be the angle between I_1 and I_2 (taken positive for I_2 leading I_1, and negative when I_2 lags behind I_1). Let I_{s_1}, I_{s_2} and I_{s_3} be the three balanced components of I_1, I_2 and I_3, having the same sequence of phases as I_1, I_2 and I_3, and let I_{i_1}, I_{i_2} and I_{i_3} be the three balanced components of I_1, I_2 and I_3, having the opposite sequence of phases. The currents I_{s_1}, I_{s_2} and I_{s_3} will be designated as the *synchronous* components and the currents I_{i_1}, I_{i_2} and I_{i_3} as the *inverse* components of the three unbalanced currents I_1, I_2 and I_3. Let α be the angle by which the synchronous component I_{s_1} lags behind I_1, and let β be the angle by which the inverse component I_{i_1} leads I_1. The symbol I_s will be used for the numerical value of each synchronous component and I_i for the numerical value of each inverse component.

Choosing I_1 as the reference vector, the symbolic (or vector) expressions for the several currents are then

$$\dot{I}_1 = I_1 + jo, \tag{1}$$

$$\dot{I}_2 = I_2(\cos\gamma + j\sin\gamma), \tag{2}$$

$$\dot{I}_{s_1} = I_s(\cos\alpha - j\sin\alpha), \tag{3}$$

$$\dot{I}_{s_2} = I_s[\cos(120-\alpha) + j\sin(120-\alpha)], \tag{4}$$

$$\dot{I}_{i_1} = I_i(\cos\beta + j\sin\beta), \tag{5}$$

$$\dot{I}_{i_2} = I_i[\cos(120-\beta) - j\sin(120-\beta)]. \tag{6}$$

The neutral is assumed to be not grounded; therefore the vectors representing the three currents I_1, I_2 and I_3 form a triangle, as shown in Fig. 3. This fixes the value of γ as

$$\cos\gamma = \frac{I_3^2 - (I_1^2 + I_2^2)}{2I_1I_2}. \tag{7}$$

It is desired to find the values of A, B, α and β which will satisfy the conditions:

$$\dot{I}_1 = \dot{I}_{s_1} + \dot{I}_{i_1},$$
$$\dot{I}_2 = \dot{I}_{s_2} + \dot{I}_{i_2},$$
$$\dot{I}_3 = \dot{I}_{s_3} + \dot{I}_{i_3}.$$

Only two of these conditions are independent, for if the first two hold the third must also hold, since $\dot{I}_3 = -(\dot{I}_1 + \dot{I}_2)$. Substituting in the first two of these relations the values of the quantities given by equations (1) to (6), and equating the real and j terms, there results

$$I_1 = I_s\cos\alpha + I_i\cos\beta,$$
$$o = -I_s\sin\alpha + I_i\sin\beta,$$
$$I_2\cos\gamma = I_s\cos(120-\alpha) + I_i\cos(120-\beta),$$
$$I_2\sin\gamma = I_s\sin(120-\alpha) - I_i\sin(120-\beta).$$

These four equations are sufficient to determine the four unknowns I_s, I_i, α and β. These equations are most conveniently solved by expanding the last two and substituting for $I_i\cos\beta$ and $I_i\sin\beta$ their values in terms of I, $I_s\cos\alpha$, and $I_s\sin\alpha$ as given by the first two of these equations. This gives

$$I_s = \sqrt{\frac{I_1^2 + I_2^2 - 2I_1I_2\cos(\gamma+120)}{3}}, \tag{9}$$

$$I_i = \sqrt{\frac{I_1^2 + I_2^2 - 2I_1I_2\cos(\gamma-120)}{3}}, \tag{10}$$

$$\tan\alpha = \frac{I_1 + 2I_2\cos\gamma}{\sqrt{3}I_1 + 2I_2\sin\gamma}, \tag{11}$$

$$\tan\beta = \frac{I_1 + 2I_2\cos\gamma}{\sqrt{3}I_1 - 2I_2\sin\gamma}. \tag{12}$$

An inspection of these four equations shows that the synchronous component (I_{s_1}) of the current I_1 is equal to $\frac{1}{\sqrt{3}}$ times the vector sum of a vector equal in length to I_1 but 30 deg. behind I_1 and a vector equal in length to I_2 but 90 deg. ahead of I_2, and that the inverse component (I_{i_1}) of the current I_1 is equal to $\frac{1}{\sqrt{3}}$ times the vector sum of a vector equal in length to I_1 but 30 deg. ahead of I_1 and a vector equal in length to I_2 but 90 deg. behind I_2. The synchronous component (I_{s_2}) of the current I_2 is then 120 deg. ahead of I_{s_1} and the inverse component (I_{i_2}) of the current I_2 is 120 deg. behind I_{i_1}. The synchronous component (I_{s_3}) of the current I_3 is 120 deg. behind I_{s_1} and the inverse component (I_{i_3}) of the current I_3 is 120 deg. ahead of I_{i_1}.

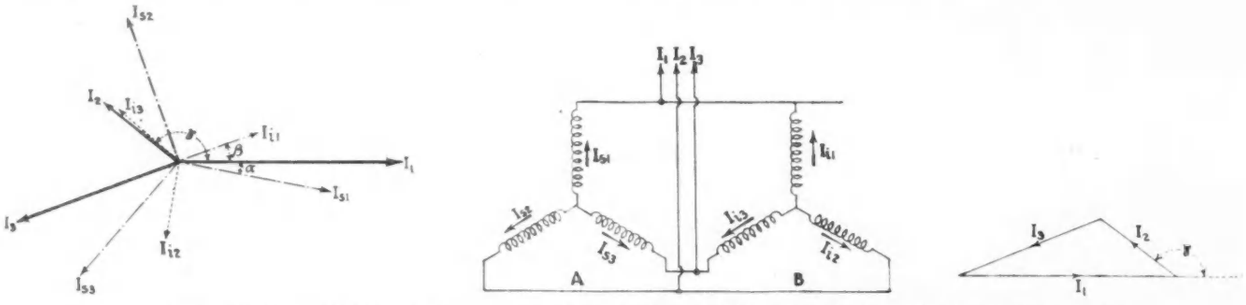
When the armature currents are balanced, $I_1 = I_2$ and

$\gamma = 120$. Equations (9) to (12) then give $I_s = I_1$, $I_i = o$, $\alpha = o$, and $\beta = o$; that is, there is no inverse current when the load is balanced. When the alternator is operated single-phase, say with the load connected across terminals 1 and 3, the current I_2 is zero, and $I_3 = I_1$. Equations (9) to (12) then give $I_s = \frac{I_1}{\sqrt{3}}$, $I_i = \frac{I_i}{\sqrt{3}}$, $\alpha = 30$ deg. and $\beta = 30$ deg.; that is, the synchronous and inverse components of the armature currents are equal and each equal to the single-phase current divided by $\sqrt{3}$.

Armature Reactions Due to the Synchronous and Inverse Currents.—The synchronous components I_{s_1}, I_{s_2} and I_{s_3} of the armature currents produce a magnetic field which rotates at synchronous speed with respect to the armature in the same direction as the rotating field produced by the rotating-field structure (stationary armature assumed). This magnetic field is therefore stationary with respect to the rotor and the field coils, and the effects produced by it are the same as the effects of armature reaction were the alternator delivering balanced currents equal to and in phase with the synchronous components of the actual currents.

The inverse components I_{i_1}, I_{i_2} and I_{i_3} of the armature currents produce a magnetic field which rotates at synchronous speed with respect to the armature, but in the direction opposite to that of the rotor. Therefore with reference to the rotor this field is rotating at the exciting circuit the less will be the resultant magnetic field produced by these inverse components. A condenser shunting the field coils therefore is not only of advantage in keeping the double-frequency current out of the external part of the exciting circuit but also serves as a means of reducing the reactive voltage of these inverse currents in the armature itself.

In general, any alternating field may be resolved into two constant rotating fields revolving in opposite directions, each with a speed ω, where $\omega = 2\pi$ times the frequency of the alternating field. Therefore the alternating field produced by the double-frequency current in the field coils may be resolved into a constant field rotating with respect to the rotor at a speed proportional to $2f$ (where f is the frequency of the armature currents) and in the same direction as the rotor, and an equal constant field rotating with respect to the rotor at a speed proportional to $2f$ in the opposite direction. Since the rotor is rotating with a speed proportional to f, it follows that the first field rotates with respect to the armature at a speed proportional to $f + 2f = 3f$, and the second at a speed of $f - 2f = -f$ with respect to the armature. The first field will therefore induce a voltage of triple frequency in the armature, i.e., will produce a third harmonic in the armature emf. The second field being of the same frequency, and practically in direct opposition to the field produced by the armature currents, will tend to neutralize the field of the latter, as pointed out above.



FIGS. 1, 2 AND 3—EQUIVALENT CIRCUITS AND CURRENTS IN AN UNBALANCED THREE-PHASE SYSTEM

a speed equal to twice synchronous speed and consequently induces in the field coils a voltage of twice the frequency of the armature current. With respect to this magnetic field the field coils act like the secondary of a series transformer of which the primary is the armature winding, but, owing to the relative motion of the armature and field circuits, the frequency of the induced voltage and current is double normal frequency.

As the ratio of field turns to armature turns is usually very large, frequently being as high as fifty to one, it is evident that the opening of the field circuit of an alternator delivering an unbalanced load may be accompanied by the induction of a high, and possibly destructive, voltage in the field coils. Normally, however, the field circuit will be closed (through the exciter), and, therefore, superimposed upon the direct current in the field coils will be an alternating current of double frequency. This alternating current in the field coils may reach a value sufficient to operate the field circuit-breaker should the unbalancing become great, and this opening of the field circuit would be accompanied by the rise in voltage just referred to. To prevent these conditions arising, the field circuit may be shunted by a condenser of sufficient capacity to give a path of low impedance to this double-frequency alternating current.

Since the field coils act like the secondary of a current transformer with respect to the magnetic field produced by the inverse components of the armature currents, it is evident that the lower the impedance of

Since shunting the field circuit with a condenser tends to keep down the resultant double-frequency magnetic field in the rotor, a condenser used in this manner will also reduce the value of the triple-frequency component in the armature voltage.

It should be particularly noted that this third harmonic does not arise from the presence of a third harmonic in the flux distribution in the air-gap, but from the double-frequency current produced in the rotor owing to the unbalancing of the armature currents. As is well known, a third harmonic due to the former cause cannot appear in the line voltage of a three-phase alternator, but a third harmonic due to the latter cause can and does appear in the line voltage of such an alternator when the currents are not balanced.

Vector Diagram of the Unbalanced Generator.—Let E be the no-load voltage per phase (terminal to neutral point of the Y) for a given field excitation and let E_1 be the terminal voltage of phase No. 1 for the same excitation when the alternator is delivering the unbalanced currents I_1, I_2 and I_3. The relation between E_1 and E may then be written in vector notation:*

*The induced triple-frequency voltage e_3 produced by the double-frequency current induced in the field is here neglected. Its effect on the root-mean-square value of the terminal voltage will be small, since the general expression for the root-mean-square value V_r of a wave containing a fundamental of root-mean-square value V_1 and a triple frequency of root-mean-square value V_3 is

$$V_r = \sqrt{V_1^2 + V_3^2}$$

For V_3 as much as 10 per cent. of V_1, the value of V_r is only 0.5 per cent greater than V_1.

$$\dot{E}_1 = \dot{E} - \dot{E}_{sd} - \dot{E}_{sc} - \dot{E}_l - \dot{E}_i - \dot{E}_r. \quad (13)$$

The voltage E, which is due to the field current only, is taken as the reference vector. The meaning and values of the several reactions E_{sd}, E_{sc}, E_l, E_i and E_r are given below.

The armature ampere turns due to the synchronous component of the armature currents may be conveniently resolved into two components, viz., a demagnetizing component acting in phase with the field ampere turns and a cross-magnetizing component acting at right angles to the field ampere turns. The axis of the rotating field due to the synchronous components makes an angle $(90 - \theta_s)$ with the axis of the field produced by the exciting current in the field coils, where θ_s is the angle by which the synchronous component in any phase lags behind the emf E induced by the field current only. Hence the demagnetizing component of the armature ampere turns due to the synchronous components is equivalent to a *demagnetizing* field current having the value

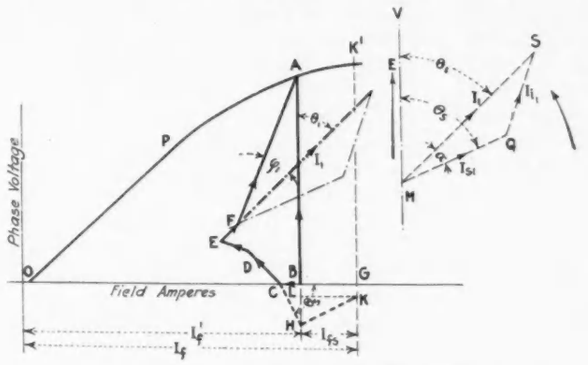


FIG. 4—CONSTRUCTION OF VECTOR DIAGRAM

$$I_{fs} = aI_s \cos \theta_s, \quad (14)$$

where a is a factor of proportionality. The voltage E_{sd} in equation (13) is the back emf due to the field produced by these demagnetizing ampere turns. Instead of determining this voltage directly, it is more convenient to subtract the equivalent demagnetizing field current I_{fs} from the actual field current I_f, and then read on the open-circuit characteristics of the alternator the voltage

$$E' = E - E_{sd} \quad (15)$$

corresponding to a field current of

$$I_f' = I_f - I_{fs}, \quad (16)$$

The voltage E_{sc} in equation (13) represents the back emf induced in the phase under consideration by the field produced by the cross-magnetizing component of the armature ampere turns due to the synchronous components of the armature currents. This back emf is 90 deg. ahead of the induced emf E, and therefore also 90 deg. ahead of the voltage E', equation (15). Its value is proportional to the component of I_s in phase with E, viz.,

$$E_{sc} = bI_s \cos \theta_s, \quad (17)$$

where b is a factor of proportionality.

The voltage E_l in equation (13) represents the back emf due to the leakage reactance of the armature, and is 90 deg. ahead of the total current I_1 in the phase under consideration. Its value may be expressed as

$$E_l = x_l I_1, \quad (18)$$

where x_l is the leakage reactance per phase.

The voltage E_i in equation (13) represents the back emf induced in the phase under consideration by the field produced by the inverse components of the armature currents. This voltage may, as a first approximation, be taken as proportional to the inverse current and 90 deg. ahead of the inverse current in the phase under consideration. Its value may then be expressed as

$$E_i = x_i I_i, \quad (19)$$

where x_i is a factor of proportionality.

The voltage E_r in equation (13) represents the loss of voltage due to the armature resistance in the phase under consideration. It is in phase with the total current I_1 and is proportional thereto, viz.,

$$E_r = rI_1, \quad (20)$$

where r is the armature resistance (effective value) per phase.

The vector diagram of equation (13) may then be constructed as follows. Referring to Fig. 4, the curve OPA is the open-circuit characteristic of the alternator, plotted with volts to neutral as ordinates against field current as abscissas. In Fig. 4*a* the line MV represents the direction of the emf E due to the field current only (i. e., the open-circuit terminal voltage). The current in any phase, say phase No. 1, will lag behind this voltage by an angle θ_1, which may be called the "internal" power-factor angle. The vector MS represents the current in this phase laid off at the angle θ_1 behind the voltage E. The vectors MQ and QS represent the synchronous and inverse components of I_1, and the angles α and β their phase angles, calculated from equations (9) to (12). The angle θ_s is the angle by which MQ lags behind E.

Lay off OG, in Fig. 4, equal to the given field current I_f. Lay off BG equal to I_{fs}, where I_{fs} is given by equation (14). Then BA represents E', equation (15). Lay off BC equal to E_{sc}, given by equation (17). Lay off CD equal to E_l and 90 deg. ahead of I_1, calculating E_l from equation (18). Lay off DE equal to E_i and 90 deg. ahead of I_i, calculating E_i from equation (19). Lay off EF in phase with I_1 and equal to E_r, given by equation (20). Then FA is the terminal voltage E_1 (terminal to neutral), and the angle φ_1, between FA and EF extended, is the power-factor angle of the external load, i. e., the angle by which I_1 lags behind the terminal voltage E_1.

The above construction is based upon the assumption that the phase angle θ_1, and therefore θ_s, is known. The premises usually given are the field current I_f, the armature currents I_1, I_2 and I_3, and the power-factor angles φ_1, φ_2 and φ_3 of the external load, and the desired quantities are the three terminal voltages E_1, E_2 and E_3. When the premises are as stated the following construction may be used. Note first that if the line CH in Fig. 4 is drawn perpendicular to I_{s_1} and HK per-

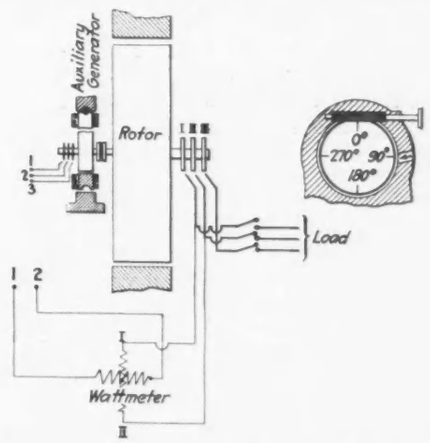


FIG. 5—METHOD OF DETERMINING SHIFT IN PHASE

pendicular to CH, then the angle BCH is equal to θ_s. Therefore,

$$CH = \frac{BC}{\cos \theta_s} = \frac{E_{sc}}{\cos \theta_s} = bI_s. \qquad (21)$$

See equation (17). Also

$$HK = \frac{KL}{\sin \theta_s} = \frac{GB}{\sin \theta_s} = \frac{I_{fs}}{\sin \theta_s} = aI_s. \qquad (22)$$

See equation (14). Whence CH and HK are fixed in length and direction irrespective of the phase angle θ_s, their lengths depending only on the synchronous component I_s. Therefore when I_1, I_2 and I_3 are given, thereby fixing I_s, I_i, α and β by equations (9) to (12), the broken line $KHCDEF$ may be laid off, as well as the direction of FA (the angle φ_1 being also given). To find the length of FA draw this broken line on a piece of transparent paper and place this diagram over the open-circuit characteristic in such a position that the point K lies on the ordinate (extended) corresponding to the given field current and the line FA intersects the open-circuit characteristic at such a point A that the line through H and A is perpendicular to the horizontal axis OG. The length of FA is then equal to the terminal voltage E_1.

The construction above described for phase No. 1 may also be applied to the other two phases, laying off the synchronous and inverse components of I_2 and I_3 in their proper directions with respect to I_2 and I_3 as given in Fig. 1.

To show the accuracy of the above-described method of calculation the accompanying table is given of observed and calculated quantities for a 5-kw, 120-volt, fifty-cycle, three-phase star-connected alternator. The armature currents were $I_1 = 15.4$, $I_2 = 7.4$ and $I_3 = 12.4$.

DATA ON OBSERVED AND CALCULATED QUANTITIES FOR STAR-CONNECTED ALTERNATOR

Quantity	Phase 1		Phase 2		Phase 3	
	Obs.	Cal.	Obs.	Cal.	Obs.	Cal.
Terminal voltage to neutral.....	71.9	71.2	73.8	74.0	76.0	76.5
Volts between terminals.....	123.8	123.0	131.7	132.3	126.7	127.5
Internal power-factor angles*....	41° 27′	41° 59′	48° 10′	48° 58′	10° 28′	9°50′

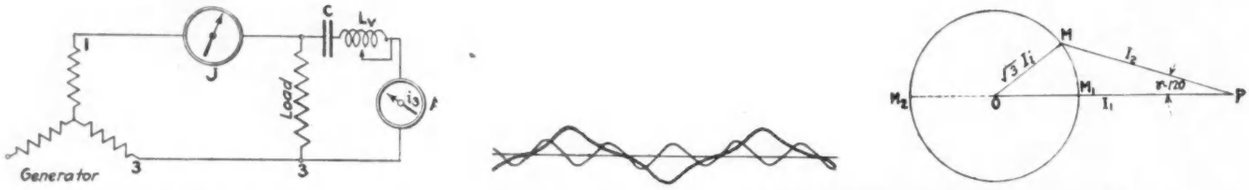
*The angles θ_1, θ_2 and θ_3 between the voltage E and the armature current for each phase. The method of measuring these angles is given below.

Determination of the Constants of the Alternator.—To apply the above method to calculation it is necessary to know the constants a, b, x_l, x_i and r of the machine. The constants a, x_l and r are determined in the usual manner. When these three constants have been determined, the constant b may be determined by putting a balanced non-inductive load on the generator and measuring the internal power-factor angle θ. From Fig. 4 this angle is equal to the angle FAB when $\varphi_1 = o$ (non-inductive load); that is θ is equal to the angle by which the load causes the terminal voltage to shift in phase.

Ossanna has developed an ingenious method for determining this shift in phase, which is as follows: To the rotor of the generator for which the angle θ is to be determined is coupled a small test generator (Fig. 5), the stator of which may be revolved through any angle by means of a worm-wheel. The generator is first run without load and two of its terminals (I-II) are connected to the pressure coil of a wattmeter, the current coil of which is connected across two terminals (1-2) of the test generator. The stator of the test generator is revolved until the hand of the wattmeter is on zero. In this condition the emf of the test generator is in quadrature with the terminal voltage of the main generator. A balanced non-inductive load is then connected to the terminals of the latter, and in order to obtain again zero indication of the wattmeter it will be necessary to shift the stator of the test generator through an angle equal to the angle through which the terminal voltage of the generator has shifted, i. e., through the angle θ. Having found this angle θ, the constant b may then be found from the construction given in Fig. 4. This same method may be used for finding θ_1 when φ_1 has any value, for in general the angle FAB is equal to $\theta_1 - \varphi_1$ (see Fig. 4).

The constant x_i can be found by determining the effective value of the triple-frequency voltage induced in the armature when operated single-phase. This triple-frequency voltage will be proportional to the inverse component I_i, which in this case has the value

$$I_i = \frac{I_1}{\sqrt{3}}. \qquad (23)$$



FIGS. 6, 7 AND 8—APPARATUS, CURVES AND ANALYSIS OF OSCILLOGRAPHIC INVESTIGATION

This relation follows immediately from equation (10), for when the alternator is operated single-phase $I_2 = o$. The triple-frequency voltage may then be written

$$e_3 = kI_i = \frac{kI_1}{\sqrt{3}}. \qquad (24)$$

The voltage E_i—see equation (19)—is developed by a field of the same magnitude as that which produces e_3, but rotating in the opposite direction. The constant x_i should therefore be equal to $k \div 3$, except for the fact that the eddy currents due to the triple-frequency flux in the armature are greater than the eddy currents produced by the normal frequency flux which gives rise to E_i. As a first approximation, however, x_i may be taken to have the value

$$x_i = \frac{k}{3}. \qquad (25)$$

The constant k may be determined by means of the connections shown in Fig. 6. The inductance and capacity are adjusted to resonance with the triple-frequency. Let i_3 be the triple-frequency current measured by an ammeter or other device A in series with the inductance, and let R be the effective resistance, at this frequency, of the coil and condenser in series. Then $e_3 = Ri_3$, and therefore

$$k = \frac{Ri_3\sqrt{3}}{I_1}. \qquad (26)$$

In general the current through the device A used to measure i_3 will contain a small component of fundamental frequency. By using an oscillograph, however, the effect of this latter component may be eliminated. Fig. 7 is an oscillogram obtained in this way.

Limit Circle for the Third Harmonic.—Referring to equation (10) it is evident that $\sqrt{3}I_4$ is the third side of a triangle whose other two sides are I_1 and I_2, the angle between these two sides being $\gamma - 120$ (see Fig. 8). Note that γ is the angle by which the smallest of the three armature currents leads the largest. Since the triple-frequency voltage induced in the armature is proportional to I_4, it follows that any combination of unbalanced currents which gives the same value of I_4 will give the same triple-frequency voltage in the armature. Hence, if a circle is drawn with a radius equal to $\sqrt{3}$ times that value of I_4 which gives the maximum permissible triple-frequency voltage, the limiting values of I_2 and γ for a given value of I_1 will be such that the point M in Fig. 8 lies on this circle. For a given value of I_1, the current I_2 and the angle γ may have any value such that the point M lies within the circle. When I_2 and γ are such that M lies without the circle the triple-frequency voltage will exceed the permissible value.

Extension of Above Method of Calculation to Alternator with Grounded Neutral.—When the neutral is grounded (i. e., when the neutral of the alternator is connected to the neutral of the load), the three-phase currents do not form a closed triangle, but instead these three currents and the neutral current I_0 form a four-sided polygon. In vector notation, then

$$\dot{I}_1 + \dot{I}_2 + \dot{I}_3 + \dot{I}_0 = 0.$$

The current in phase No. 3 may, however, be considered as made up of two components, viz., a component

$$\dot{I}_3' = -(\dot{I}_1 + \dot{I}_2)$$

and a component

$$\dot{I}_3'' = -\dot{I}_0.$$

The alternator may then be considered as delivering two unbalanced loads with ungrounded neutral, viz.,

$$I_1,\ I_2 \text{ and } I_3'$$

and

$$0,\ 0 \text{ and } I_3''.$$

The reactions due to each of these loads may be calculated as above described. The resultant reactions will be the vector sum of these two sets of reactions.

The "Electric Dog" and Possibilities of Torpedo Control by Beams of Light

The possibility of equipping torpedoes with directive mechanism which would automatically cause them to be steered toward—and to follow and sink—battleships or other hostile vessels from which searchlamps were being operated has been suggested by the "electric dog" and other applications of selenium cells sensitive to light intensity demonstrated by Mr. B. F. Meissner, a student of electrical engineering at Purdue University, Lafayette, Ind., before several recent meetings of electrical men in the West.

By means of a small hand flashlamp directed at the "dog's" "eyes" (lenses behind which are mounted selenium control cells), the speaker caused the curious box on wheels to follow him about the stage, turning corners and avoiding chairs with no other control than that of the beam of light. By reversing a switch on the "dog" the mechanism was similarly made to back away from the source of light. The "dog" in each case started into motion quickly when the light was thrown onto its lenses and stopped just as promptly when the lamp was extinguished or turned away.

Storage cells inside the case furnish energy to drive the motor which propels the dog. Each of the selenium cells behind the eye lenses controls a relay which actuates the motor and one of the two steering magnets at the rear of the device. Illuminating a cell on one side starts the motor and turns the rear wheel to that side; illuminating both cells equally causes the mechanism to run straight forward. Thus the action of the

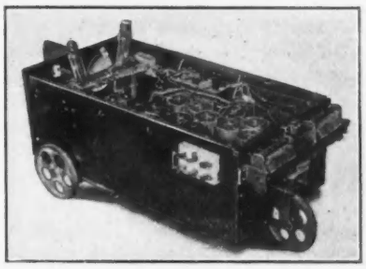


FIG. 1—MECHANISM OF THE "DOG," SHOWING SELENIUM CELLS, BATTERIES, STEERING MAGNETS, ETC.

control mechanism is to keep the two lenses always equally illuminated and pointed at the source of light—in whatever direction that source moves. The idea of the light-controlled "dog," it is explained, was suggested by Mr. John Hays Hammond, Jr., and the mechanism shown was worked out by Mr. Meissner. It has been proposed that torpedoes and submarines be equipped with directive mechanism of this kind which would cause them to follow and destroy any battleship which was using her searchlamps to sweep the seas in an effort to detect approaching craft. However she might be maneuvering, such a vessel would have little chance of escaping her unknown menace, except by extinguishing her searchlamps. Indeed, in a sea filled with selenium-controlled torpedoes searchlamps of any kind would be sources of hazard rather than protection.

Other experiments shown by Mr. Meissner included the ringing of bells, extinguishing of lamps, firing of a revolver, etc., by a beam of light from a distant arc.

In closing, the speaker showed the electric "thief catcher," which is actuated by the light of the supposed burglar's hand lantern. At the slightest illumination of the sensitive cell by the rays from the

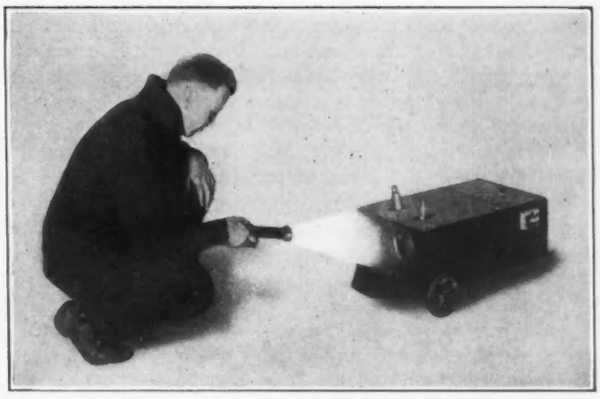


FIG. 2—THE "ELECTRIC DOG" FOLLOWS THE FLASHLAMP IN ITS MASTER'S HAND

marauder's flashlamp an alarm was sent in and a bell set ringing, a revolver began firing, and a flashlight powder was set off, taking the burglar's photograph. Mr. Meissner has suggested that the directive mechanism employed in the "dog" might be applied to the aiming of the revolver, thus leaving the robber no chance of escape.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Standardization Rules.—L. SCHUELER.—The conclusion of his long report on the new standardization rules of the American Institute of Electrical Engineers, with a comparison with German standardization rules. The permissible temperature rise in machines is first discussed. The table gives a comparison between the permissible temperatures in the United States and in Germany. Both the final permissible temperature and the increase in temperature are given in degrees Centigrade.

PERMISSIBLE TEMPERATURE RISE

	Germany		United States	
	Final Permissible Temperature, Deg. C.	Increase of Temperature, Deg. C.	Final Permissible Temperature, Deg. C.	Increase of Temperature, Deg. C.
Standard 220-volt direct-current machine:				
Field coils (impregnated cotton)	95	60	95	55
Armature winding (impregnated cotton)	85	50	95	55
Armature iron	85	50	95	55
Commutator (200 amp per brush-holder, mica insulation)	90	55	125	85
Bearings	80	45	..	..
Large 5000-volt three-phase motor:				
Stator winding (impregnated cotton)	85	50	95	55
Rotor winding (bar winding with paper insulation)	95	60	90	50
Slip-rings (mica insulation)	115	80	125	85
Large 10,000-volt, three-phase turbo-generator:				
Stator winding (cotton insulation with wedges in the slots)	95	60	90	50
Rotor winding (paper insulation)	95	60	95	55
Air-cooled oil transformer:				
Coils	105	70	95	55
Oil	95	60	90	50
Water-cooled oil transformer:				
Coils	105	70	75	50
Oil	95	60	85	60

As shown in the table, the differences between the permissible temperatures are in general small, with the exception of the oil transformer, for which the German regulations permit a rather high temperature. On the other hand, for armature windings insulated with impregnated cotton the American rules permit a temperature higher by 10 deg. than do the German rules, while for the rotor windings of large three-phase motors the American rules permit 90 deg. C. and the German rules 95 deg. C. The high commutator temperature permitted in the United States would be objected to in Germany. The rules on traction motors, overload tests, increased speed, insulation tests, voltage measurement in the perforation test, and the determination of efficiency and voltage drop, are also discussed.—*Elek. Zeit.*, March 18, 1915.

Theory of Transformers.—JOHANN LISSNER.—A highly mathematical paper developing the fundamental formulas of the theory of the stationary transformer. The theory neglects eddy currents, saturation phenomena and hysteresis, but it is otherwise exact. A simple circular diagram is developed.—*Elek. u. Masch.* (Vienna), March 28, 1915.

Calculation of Transformers.—ROGER CHAVANNES.—A long mathematical article on the calculation of single-phase and three-phase transformers. The author reviews the methods of R. Pohl and H. Bohle and the method of Vidmar, compares the two methods, and shows how to combine them.—*La Revue Elec.*, Dec. 18, 1914 (published March 26, 1915).

Dimensions of Transformers.—A. R. LOW.—Supplementing some earlier work in which he developed a graphical method for determining approximately the minimum volumes, costs and losses of transformers, the author presents a more powerful method for determining directly the "best" dimensions, but one which loses the advantages of graphical representation. In his former paper approximate formulas were given for the dimensions, which involved only multiplication, division and root extraction. Rigorous solutions are given in the present paper for the same problems, requiring the solution of a quintic and a cubic equation. Both methods offer interesting applications of the theory of maximum and minimum values of algebraic functions of several variables. A bibliography is added.—*Journ. Inst. of Elec. Eng.* (London), April 1, 1915.

Lamps and Lighting

The Nitrogen-Filled Tungsten Lamp for Photographic Purposes.—W. VOEGE.—The author advocates the use of the nitrogen-filled tungsten lamp for photographic purposes, but states that it must be used at higher than normal voltage. Of course, this shortens the life, but this disadvantage is more than compensated by the following advantages. Fig. 1 shows how a

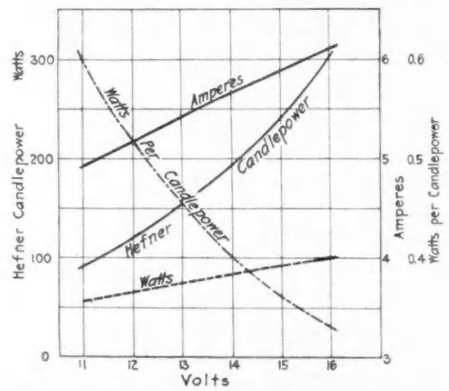


FIG. 1—CHARACTERISTICS OF NITROGEN-FILLED LAMP AT INCREASED VOLTAGE

normal 12-volt, 100-cp nitrogen-filled tungsten lamp behaves when the emf is varied between 11 volts and 16 volts. The abscissas are volts, and curves are given for amperes, watts, hefner candle-power, and watts per candle-power. When the voltage is raised from 12 to 15—that is, by 25 per cent—the candle-power is raised from 120 to 245—that is, by 100 per cent. But, what is more important for photographic purposes, the greatest increase in the candle-power is in the blue and violet parts of the spectrum. To get exact figures the 100-cp lamp was compared by means of seven color filters in seven different regions of the spectrum with a standard comparison lamp of 25 cp and 1.2 watts per candle. The results are given in Fig. 2. The abscissas are wave lengths. Three sets of curves are given of 11, 12 and 15 volts respectively. The straight dotted lines parallel to the axis of abscissas relate to the comparison lamp, and the curves are so plotted that the two lamps have the same candle-power in the dark red. It will be seen that if the nitrogen-filled lamp at 11 volts and the comparison lamp at 110 volts have the same candle-power in the dark red, the candle-powers in the blue have the ratio of 28.5 to 21 or 1.35. For 15 volts this ratio is 115 to 46.5, or 2.6. It would be unsuitable to use 50-cp or 100-cp lamps, as they would have a short life if

operated at such increased voltages, but a nitrogen-filled lamp of 1500 cp with a normal voltage of 78 has been operated for more than 100 hours at 102 volts, although the lamp was often connected to and disconnected from the circuit. After 100 hours of operation the globe was not yet too black, and the lamp could have been used still further, but on account of vibration the

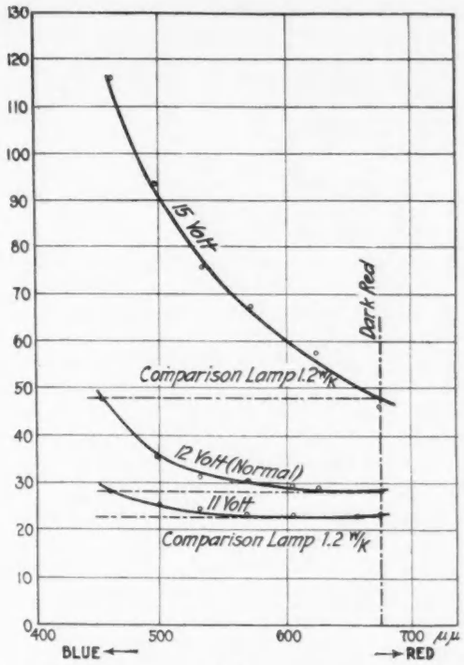


FIG. 2—COMPARISON OF 100-CP LAMP OPERATED OVER-VOLTAGE WITH STANDARD LIGHT SOURCE

filament broke, since it had become very brittle. In practice a life of from forty to fifty hours of operation may be relied on. This is sufficient since for a photographic picture an exposition of not more than ten seconds is necessary. For copying blueprints the nitrogen-filled tungsten lamp is not suitable, but for photographs it is. If a photographer's studio is wired for 110 volts, a lamp designed for 85 volts should be used and operated with a small series resistor. For a 3000-cp lamp consuming 15 amp the resistance should be from 1.6 ohms to 1.7 ohms. When a photographic picture is to be taken the series resistor is short-circuited so that the full emf of 110 volts is now impressed on the lamp. When the picture has been taken the short-circuit of the series resistor is broken.—*Zeit. f. Beleucht.*, March, 1915.

Street Lighting.—ELY.—An account of comparative tests of different lamps for street lighting carried out in Nurnberg. Four types of lamps were used—first,

COMPARATIVE TESTS OF LAMPS FOR STREET LIGHTING

	Watts per Lux per 100 Sq. M.	Ratio of Maximum to Minimum Illumination
12-amp flame-arc lamps	9.24	19.2
T B." carbon amps	9.50	17.3
Nitrogen-filled incandescent lamps, two of 600 cp	9.37	25.4
Compressed-gas incandescent lamps	*	25

*13 liters per hour.

flame-arc lamps consuming 12 amp at 42 volts (0.550 kw, including transformer and induction coil); second, "T. B." carbon arc lamps operated at the same current; third, fittings containing two nitrogen-filled tungsten lamps of 600 cp, consuming 620 watts; fourth, compressed-gas Welsbach lamps with two mantles rated at 750 cp, consuming 750 liters per hour. The measurements of the first three types of lamps were made on a free square of 960 sq. m area at a height of 1 m above the ground. The height of the lamps above the ground was 8 m, the distance between the lamps 40 m. The results were as shown in the table. The arc lamps show the lowest specific consumption, which would be still less for the series system. For narrow streets with heavy traffic nitrogen-filled incandescent lamps are to be recommended because they are smaller units and need no attendance. Compared with compressed gas, they have the advantage of smaller cost of installation and operation—*Mitt. Vereing. Elek. Werke*, No. 158, 1914; abstracted in *Elek. u. Masch.* (Vienna), Feb. 7, 1915.

Installations, Systems and Appliances

Avoiding the No-Load Losses in Transformers.—BR. THIERBACH.—Factories usually receive electrical energy in form of high-tension current. The energy is measured by a meter in the high-tension line. All transformer losses are charged to the factory. It is, therefore, in the interest of the factory to have the transformer disconnected whenever possible. During the night and on holidays energy is needed for emergency cases and perhaps for lighting some rooms. For this purpose it is advantageous for the factory to install small transformers of only 1 kw and 2 kw for use in the night. The arrangement should be made as shown in Fig. 3, where 1 is the large transformer which supplies energy during the day and 2 is the small auxiliary night transformer; 3 are the high-tension lines, 4 the low-tension busbars which supply energy to the factory 10; the meter 9 is installed in the high-tension line; 5 is the high-tension oil-switch for the large transformer; 6 and 7 are switches in the low-tension line. The switch 7 is necessary since otherwise, even if the oil-switch 5 would be opened the small transformer 2 would send its current into the large transformer and energy would be lost as no-load loss. The cost of installation of the small transformer is negligible compared with the no-load loss of the large transformer which can be saved. If we assume twelve night hours each on 300 working days and sixty-five holidays or Sundays, each of twenty-four hours, the large transformer is not needed for 5160 hours during the year. If the rating of the connections is 600 kw and the energy is paid for at the rate of 2 cents per kw-hr., and if the iron loss is figured as 2 per cent, the no-load

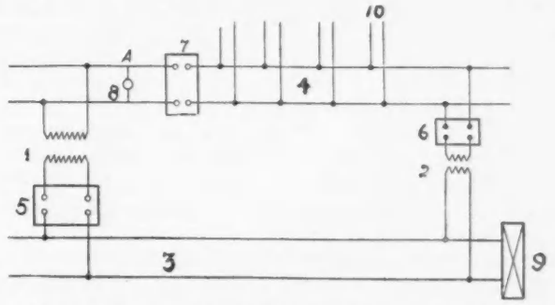


FIG. 3—WIRING ARRANGEMENT FOR AVOIDING TRANSFORMER NO-LOAD LOSSES

loss which can be saved amounts to $1,240. Careful attendance is, however, necessary, and this can be obtained in the simplest way if at the point *A* of the low-tension line an ordinary service-time meter 8 is installed which registers or records the hours during which current passes in the low-tension line from the large transformer. If the factory does not buy the

energy at high-tension, it is in the interest of the central station to see that the large transformer is regularly disconnected. The station should therefore install the service-time meter 8 as described and charge to the consumer for every hour which the service-time meter records above the normal 3000 factory working hours a certain sum, say 0.025 cent, for every kilowatt of transformer rating. The same arrangement may be used in agricultural plants.—*Elek. Zeit.*, March 18, 1915.

Wires, Wiring and Conduits

Dielectric Properties of Insulating Materials.—Karl Willy Wagner.—A continuation of his long paper on his extended experimental investigation of the dielectric properties of various insulating materials. In the present instalment the author sums up the results obtained with guttapercha, ballata and "guttagentzsch," which is an artificial substitute for guttapercha. The author determines the charging current and discharge current as functions of the time for various insulating materials in cables. The cable was charged for 100 or 150 minutes and then short-circuited through a galvanometer and the discharge current determined for the same length of time. These investigations were carried out at different temperatures. The results are given in diagrams. The paper is to be continued.—*Elek. Zeit.*, March 18, 1915.

Electrophysics and Magnetism

The Relative Losses in Dielectrics in Equivalent Electric Fields, Steady and Alternating (Root Mean Square).—G. L. Addenbrooke.—A note on a recent (British) Physical Society paper. After references to former work, especially on surface leakage, tables are given showing an intimate connection between the losses in steady and alternating fields. It is stated that the one can be predicted from the other to a first approximation. Exceptions are mentioned, and it is shown that there is heterogeneity in these cases. Curves of the losses from one cycle to forty cycles per second are given for specimen dielectrics. Above eight to twelve cycles for both "good" and "poor" dielectrics these become rising straight lines. The salient features lie below about sixteen cycles. The formula $a + bn$ applies to all dielectrics for frequencies above about eight cycles, but not for those below. The a constant is always larger than and bears only a very indefinite relation to the steady voltage loss. Liquid dielectrics behave similarly to solid ones, with certain differences, particularly that for a given resistance the ratio of the steady to the alternating loss is less than with solids. There is a great difference in the comparative ranges of the losses. For the dielectrics tabulated these vary in a steady field from 1 to 1,300,000, but the corresponding alternating losses vary only from 1 to 1100. The difference is principally in the "good" dielectrics, the alternating losses in which at forty cycles are vastly larger than these in a steady field, though they still appear to be connected with them.—London *Electrician*, March 26, 1915.

Flux and Magnetizing Current.—A. L. Tackley.—A mathematical paper giving the mathematical relationship between flux and magnetizing-current waves at high flux densities.—*Journ. Inst. Elec. Eng.* (London), April 1, 1915.

Electrochemistry and Batteries

Organic Electrochemistry.—An account of a symposium of papers before the New York Section of the American Electrochemical Society on the electrochemical production of organic compounds. It was introduced by C. G. Fink, who emphasized the importance and the possibilities of the subject. F. A. Lidbury discussed the commercial aspects of organic electrochemistry. He compared, on the basis of reductions and oxidations equivalent to a gram molecular weight of hydrogen, energy costs involved in electrolytic methods, with energy taken at various figures, with the cost of chemical reducing and oxidizing materials. He showed that under most conditions a fair margin apparently exists, with the exception of the very cheapest reducing materials, such as iron, in favor of electrochemical methods. The difference was particularly marked in the case of oxidation, and the same remark would, of course, apply to substitutions. He pointed out, however, some difficulties in the industrial development of organic electrochemistry in this country. He stated that where there appears to be a field for the application of electrolytic methods electrochemists should be employed for investigation purposes, and that they should be given not merely a specific problem to work out, but the run of the whole particular field involved, since electrochemistry is not so much a collection of methods as a habit of thought. H. Hibbert discussed the electrolytic preparation of organic compounds. He expressed the belief that a very considerable number of intermediate products required in the synthetic-dye industry can be manufactured in this country with satisfactory financial returns. He also suggested the electrolytic production of iodoform and the use of waste dilute nitric acid for the manufacture of nitro compounds. G. S. Forbes discussed the electrolysis of aromatic compounds, and also spoke on typical oxidations, substitutions and reductions. The great number of variables in electrolysis, such as electrode material, overvoltage, current density, catalysis by the electrode or by dissolved substance, the differing effects of temperature on primary and secondary reactions, added to the variables significant in ordinary organic work, make the situation very complicated, but in these very complications lies the possibility of preparing compounds from costly materials, with greater efficiency and profit than is possible by the ordinary methods of organic chemistry. It appears probable that in cases like this the difficulties and disadvantages of the electrochemical method will be outweighed, and that electrochemical methods will prove of the greatest value.—*Met. and Chem. Eng'ing*, April, 1915.

Units, Measurements and Instruments

The Variable Resistance to Motion Offered by the Registering Trains of Electric Supply Meters.—S. Evershed.—A report to the engineering standards sub-committee on electrical plant accessories of the (British) Institution of Electrical Engineers. The chief conclusions as to pointer dials are that the only variations to be reckoned with in meters with these dials are the irregular changes which are common to all meter trains, no matter what the registering mechanism may be. These irregular changes are small, but at one-tenth load and with a worm drive they may amount to as much as 1.2 per cent either way in the case of a meter with a full-load torque as low as 1 grm cm, and perhaps as much as 0.4 per cent with a spur drive. They are quite haphazard in their occurrence, and in those instances in which low-load testing is affected by them nothing but a prolonged run will secure a fair average. In this respect there can be no short cut; time and patience are essential. When a meter has a creep counter dial of the Harding type the fall in speed at times when one or more nines are changing to zero is apt to lead to considerable discrepancies at a low load in the case of all meters which have a torque-speed product (grm cm $\times$ r.p.m.) of less than 100. The only way to avoid them is to carry out all low-load tests at times when the first digit

wheel alone is in motion. This condition is fulfilled so long as the first digit wheel is indicating any digit from 1 to 8. Although the decrease in speed which results from the increase in resistance during the nine-changing periods may be very large, the resulting under-registration over a long period of use is unlikely to amount to as much as 1 per cent. It might well be allowed for in the initial adjustment of meters. As to jump counter dials it is said that, provided the jump device is not fitted on an axle nearer to the rotor than the tens axle in a 1-kw meter, the units axle in a 10-kw meter, or the tens axle in a 100-kw meter, the periodic changes due to the rising and falling of the jumper weight and counterweight are comparatively small. They would certainly have to be reckoned with in low-load tests on meters which have a torque speed of less than 50, but in any meter of greater power the periodic change would be masked, more or less, by the irregular variations which are inherent in the friction of every kind of train. With a jump counter which has both jumper weights and counterweights, the speed rises above and falls below the normal value twice in each revolution of the axle on which the jump device is fitted, and hence there are four epochs in each revolution at which the variation passes through zero and the speed is normal. But the moment of a weight about a horizontal axis varies as the sine of the angle made with the vertical, and since the mean value of the sine is $2/\pi$ the four epochs of normal speed occur when the weights make angles of 39.5 deg., 140.5 deg., 219.5 deg. and 320.5 deg. with the vertical. Now the angular positions of the corresponding digit wheel at times when the digits 1, 4, 6 and 9 are seen at the center of the dial opening are respectively 360 deg., 144 deg., 216 deg. and 324 deg., angles which do not differ materially from those of the four epochs of normal speed. Hence if low-load tests are carried out at times when any one of the digits 1, 4, 6 and 9 is passing by the center of the dial opening the meter should be running at the normal speed corresponding with the load. By carrying out a low-load test in this way comparatively large periodic variations should not give rise to any difficulty.—*Journ. Inst. Elec. Eng.* (London), April 1, 1915.

Estimation of High Temperatures by the Method of Color Identity.—C. C. PATERSON AND B. P. DUDDING.—A brief note of a (British) Physical Society paper describing preliminary experiments in which the temperature of incandescent substances is estimated with a very fair accuracy by matching their color with that of incandescent-filament lamps working at appropriate efficiencies. These have previously been calibrated by comparison with a "black body" over a large temperature range. The comparisons are made in the field of a Lummer-Brodhun photometer, and the method has given the correct result for the melting point of platinum. An account is given of the discussion which followed the presentation of the paper.—London *Electrician*, March 26, 1915.

Inductance Coils.—H. CHIREIX.—An article giving formulas for the design of inductance coils in ring form. The case of a single wound ring is first considered. This is followed by the case of two or more concentric rings, and a rule is given for so dimensioning them as to obtain a very simple formula valid for any number of concentric rings. This method permits the construction of simple variable inductance coils.—*La Lumière Elec.*, Feb. 20, 1915.

Induction Meter.—A communication by the German Reichsanstalt admitting a single-phase induction meter by Ketterer for official calibration. The construction, method of operation and calibration are described and illustrated.—*Elek. Zeit.*, Feb. 4, 1915.

Book Reviews

THE BOY ELECTRICIAN. By Alfred P. Morgan. Boston: Lathrop, Lee & Shepard Company. 394 pages, illus. Price, $2.

The author has written to instruct boys how to make and use different types of simple electrical apparatus. The book is practical and is based on actual experiences. To the very young student for whom it is intended the book will teach much of fundamental importance and will also arouse in him an appreciation of the larger problems to be encountered later.

ELEMENTARY ELECTRICITY AND MAGNETISM. By William S. Franklin and Barry MacNutt. New York: The Macmillan Company. 174 pages, 153 illus. Price, $1.25.

The preface to this book leads one to expect a treatment very different from that adopted by other writers of elementary texts, but the reviewer does not find any striking departures from the usual methods of presentation. The matter is, however, well handled and put before the reader in a clear and interesting manner. Very little space is devoted to considerations of a purely theoretical nature, but the effects produced by electric currents and potentials are considered and explained. The illustrations and diagrams are good, and these, together with the mechanical analogies used in treating of capacity and inductance, add to the usefulness of the book. In each chapter the presentation of the subject is followed by a collection of problems which have been carefully selected to emphasize the features of practical importance. The book should be of great value as an introduction to more advanced works.

A SCHOOL ELECTRICITY. By C. J. L. Wagstaff. New York: G. P. Putnam's Sons. 250 pages, 136 illus. Price, $1.50.

In view of the large number of books dealing with elementary electricity and magnetism, it is refreshing to note a somewhat original style and method of presentation in this volume. The author has evidently had much experience with boys, and he seems to be able to arrange his matter and explain his points so that the average boy will be interested in his subject, thus getting hold of the fundamentals with little difficulty. Practical ideas, such as those of the lines of flux in the neighborhood of magnets, are emphasized, and the flux line diagrams are rendered unusually instructive. The admirable photographs of figures obtained with iron filings are also of undoubted instructional value. The ground covered is much the same as in most elementary texts on electricity, but descriptions of historic experiments involving kites, frogs and cats are omitted. Subjects that are with difficulty illustrated by classroom experiments are also omitted, and no reference will be found to X-rays, telephones and electric waves. The book is well worth the attention of all those commencing the study of electricity, and also of those teachers who are looking for new ideas in regard to the best methods of presentation.

SANITARY REFRIGERATION AND ICE MAKING. By J. J. Cosgrove. Pittsburgh: Standard Sanitary Manufacturing Company. 340 pages, 103 illus. Price, $3.50.

Although prepared doubtless as a handbook on practical refrigeration topics, this volume will serve admirably to introduce to the technique of ice-making any central-station man who has ambitions to install

a by-product ice plant or who wishes to develop a refrigerating load among his customers. Beginning with the elementary physics of the problem, the reader is first shown how to make simple theoretical calculations and is then led into practical discussions of the compression and absorption systems, the properties of ammonia and sulphur dioxide, the design of ammonia piping, expansion coils, condensers, brine circulation systems, etc. Useful chapters are those relating to methods of insulating pipes and cold-storage chambers. The work is brought up to date with a description of the Audiffren portable machine. Practical advice to the novice is embodied in the chapter on "erecting, charging and testing" a refrigerating plant, and on the care and operation of such a plant. The numerous tables and well-drawn sketches add much to the value of the volume.

ANNUAIRE POUR L'AN 1915. Publié par le Bureau des Longitudes. Paris: Gauthier-Villars et Cie. 900 pages, illus. Price, 1.50f.

This annual publication of the French astronomical bureau contains tables of physical constants, astronomical occurrences and documentary information relative to metrology, geography and meteorology. Appended to the technical section is a paper on a method of testing mirrors and lenses from the pen of M. G. Bigourdan, the well-known astronomer. This little treatise, for such it is, covers 173 closely printed pages, with 78 diagrams and illustrations. Besides general information on the testing of telescope objectives, the paper contains brief discussions of many matters specially interesting to workers in optical laboratories.

Books Received

Travaux du Laboratoire Central d'Electricité. Paris: Gauthier-Villars et Cie. 424 pages, 55 illus. and 26 plates.

The Electron Theory of Matter. By O. W. Richardson. New York: G. P. Putnam's Sons. 612 pages, 58 illus. Price, $4.50.

Die Elektrische Kraftübertragung. By Paul Köhn. Leipzig, Germany: B. G. Teubner. 122 pages, 137 illus. Price, 1.25 marks.

The Law of Electricity. By Arthur F. Curtis. Albany, New York: Matthew Bender & Company. 1034 pages. Price, $7.50.

Heat Engineering. By Arthur M. Greene, Jr., New York: McGraw-Hill Book Company, Inc. 464 pages, 198 illus. Price, $4.

Jahrbuch der Elektrotechnik. Compiled by Dr. Karl Strecker. Munich, Germany: R. Oldenbourg. 250 pages, 35 illus. Price, 10 marks.

Schopfungen der Ingenieurtechnik der Neuzeit. By Max Geitel. Leipzig, Germany: B. G. Teubner. 106 pages, 32 illus. Price, 1.25 marks.

Public Utilities: Their Fair Present Value and Return. By Hammond V. Hayes. New York: D. Van Nostrand Company. 208 pages. Price, $2.

Handbuch der Elektrizitat und des Magnetismus. In five volumes. Vol. II. Edited by Dr. L. Graetz. 135 pages, 33 illus. Price, 5.40 marks for the five volumes.

Deutscher Kalender für Elektrotechniker. In two parts. Munich, Germany: R. Oldenbourg. Part I, 656 pages, 221 illus. Part II, 356 pages, 151 illus. Price, 4 marks.

Official Report of the Second National Foreign Trade Convention. Held at the Planters' Hotel, St. Louis, Mo., Jan. 21 and 22, 1915. Issued by the secretary of the National Foreign Trade Convention; headquarters, 64 Stone Street, New York. 284 pages. Price, $1.50.

RECENT TELEPHONE PATENTS

Switching Apparatus

Most automatic connecting switches are operated by magnets through the medium of ratchets and pawls. In the system patented by Mr. F. R. McBerty and assigned to the Western Electric Company the switches are operated by a revolving shaft driven by a motor. The advantage ascribed to this method of operation is the saving in energy. An electromagnet closes the motor circuit when the call is sent in and maintains it in operation until the connection is completed.

Another patent granted to the same inventor relates to the detailed construction of the contact banks for selector switches. The contact banks are made up of cylindrical segments of molded insulation containing end clips which engage with a frame when the curved strips are laid on top of each other to form a cylindrical wall or contact bank. Each insulating strip contains a single row of perforations designed to receive the contacts.

Two other patents granted to Mr. McBerty also relate to selector switches. In these there is a central operating shaft having rotary motion only. Attached to the shaft are brushes for each horizontal row of bank contacts. The brushes which are normally withheld from contact with the bank lips are made to engage therewith by trips mounted spirally around an auxiliary shaft. The position of the auxiliary shaft determines which set of brushes will be tripped. The first electrical impulse sent to the switch selects the proper trips, thus determining the vertical co-ordinate of the contact, and the second operation is to rotate the main shaft, thereby bringing the brush in contact with the proper bank lips. The switch is restored to its normal position by rotating the main shaft until a roller strikes the brushes and lifts them. The main and auxiliary shafts are rotated from a main-drive shaft by electric clutches. In a modification of this system the trips are arranged as teeth upon a slanting bar instead of upon a shaft.

Auxiliary Uses for the Telephone

Mr. J. H. Reineke, of Bochum, Germany, has patented a system of communicating between mine cages and telephone stations on the ground by inductive action. A loop conductor is suspended between the cages, and currents are induced therein by a coil associated with the stationary instruments on the ground.

Mr. M. J. Carney, of Chicago, has patented a system by means of which fire and burglar alarm and telephone communications can be conducted over the same wire simultaneously. Separate energy sources are used for each class of signaling, however.

Mr. H. O. Rugh is the inventor of a step-by-step call box for sending a definite number of impulses in any order desired. The apparatus has been designed to prevent false impulses being sent during the process of setting.

Telephone Attachments

Mr. A. R. Langdon, of Hartford, Conn., has devised a cut-out for transmitters which may be attached to the neck of a desk stand by means of a spring clamp. The cut-out consists of an insulating box containing a push-button for opening the transmitter circuit when listening, thereby excluding disturbances caused by local vibrations.

Messrs. R. B. Adams, L. Adams, Charles H. Wells and H. G. Payne, of Westerville, Ohio, have jointly invented a disinfecting device which may be attached to any transmitter. A pneumatic bulb is employed to force the disinfecting liquid from the receptacle through a nozzle into the mouthpiece.

POWER AND OPERATING SECTION

Magnetized Metal Wall Cause of Meter Trouble

Magnetized spots in a corrugated-iron wall on which a 10-amp watt-hour meter had been mounted by the St. Paul Gas Light Company caused an appreciable inaccuracy in the registration of the meter. Having discovered that the registrations were incorrect, the meter men had considerable difficulty in locating the cause of the trouble until Mr. A. G. Munson, of the company's meter department, suggested exploring the iron wall with a pocket compass. By this means the spots were located, and to remedy the trouble the meter had to be moved. Tests were also made to prove that the corrugated iron was not carrying currents to earth.

Since this case of magnetization trouble has been cleared up, it has been found that the same difficulty is sometimes encountered when meters are set in partly closed steel boxes. Meters set in closed steel boxes are not affected by permanent magnetism which may exist in the metal because the closed box offers a complete iron magnetic circuit of less reluctance than the air path so that the lines of force pass around and not through the meter.

Expansion Loops in 14-in. Steam Header

Temperature changes that occur in the 135-ft. main steam header of the new Cleveland (Ohio) municipal lighting plant are provided for without the use of expansion joints by the multiple loop shown in Fig. 1, which is installed midway of the header. The four 6-in.

FIG. 1—EXPANSION LOOPS IN MAIN STEAM HEADER

expansion loops rise from corresponding manifolds at the ends of the header pipe. Each half of the header is firmly anchored at its midpoint (Fig. 2) so that the greatest expansion movement is limited to one-quarter of the header. The weight of the ends is borne by roller mountings, one of which is shown at the left of the illustration. All pipes are thoroughly lagged, and advantage has been taken of the inverted-U loops to arrange a doorway in the basement wall.

The header can be cut into three sections by Hopkinson-Ferranti valves, which have total openings only half the diameter of the pipe served. Conical approach

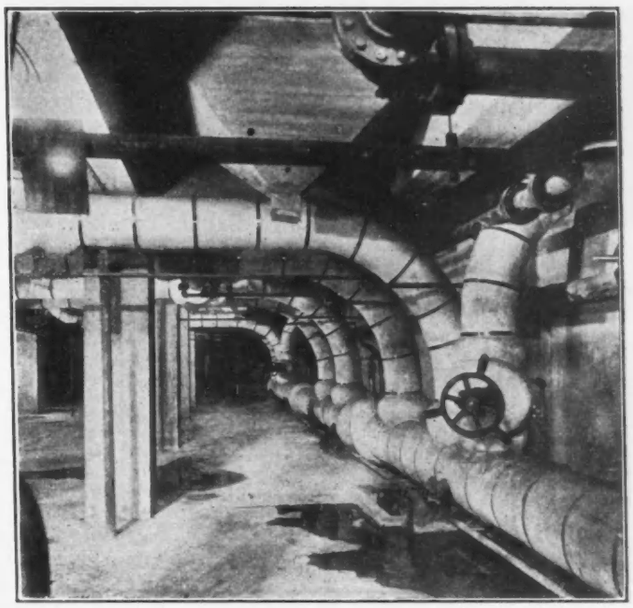


FIG. 2—BRANCH STEAM HEADERS AND SPECIAL VALVES IN MAIN HEADER

passages raise the steam velocity through the restricted openings and reduce it again on the output side, so that no appreciable drop in pressure occurs across the valves. All branch headers drain into this main header, which has pipe walls 0.625 in. thick. Fittings are avoided in general by making long bends at turns, and the sections have welded flanges.

Disposition of Refuse from a Motor-Driven Wood-Working Plant

The Rood Box Company at Columbus, Ohio, makes boxes of soft air-dried wood in a factory driven by motors using central-station service. An idea of the size of the plant can be gained from the fact that the aggregate rating of the motors used is 200 hp and the average monthly energy consumption is 8500 kw-hr.

To dispose of the by-products, sawdust, shavings and wood trimmings, at a price which makes it uneconomical to burn them under the boilers of an isolated plant, several ingenious arrangements have been worked out. Part of the shavings and all of the wood trimmings are burned under a boiler which supplies steam to dry kilns. This plant uses no kiln-dried lumber itself but dries lumber for other concerns, charging $4 per 1000 ft. of lumber dried. About fifteen days are required for drying.

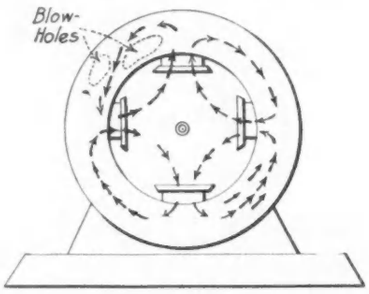
The excess shavings and sawdust are passed through a conical screen placed directly under a "cyclone" separator. The shavings and sawdust have a whirling motion imparted to them as they pass through this screen, so that the sawdust is forced through the mesh and the clean shavings drop down into a separate storage bin. The shavings are made up into bales of 80 lb. each,

and the sawdust is sold by the wagonload. The income from this sale of refuse amounts to $200 per month. About one-third of this amount comes from the sale of sawdust and the remainder from the sale of shavings.

It costs about 3 cents per bale to bale shavings, and they are sold at from 22.5 cents to 25 cents per bale. Breweries use a large percentage of the shavings for packing bottled beer in the winter time to prevent freezing. The sawdust, which sells for $2.50 per wagonload, is used by paint manufacturers for packing, by refrigerator makers for insulation, and by stablemen for bedding horses. Information regarding the operation of this plant was given before the Dayton meeting of the commercial men of the Ohio Electric Light Association by Mr. J. R. McCoy, of the sales department of the Columbus (Ohio) Railway & Light Company.

X-Ray to Locate Cause of Brush Troubles

In electrical machines with cast frames blow-holes may be present and may be large enough to increase greatly the reluctance of a section of the magnetic circuit. The reluctance being higher in one section of the circuit than in others will cause a lower voltage to be developed in a corresponding section of the armature, and local circulating currents will result. The blow-holes being concealed, it has often been found quite difficult to determine definitely whether or not they are the real cause of the trouble. According to Mr. E. H. Martindale, of the National Carbon Company, Cleveland, Ohio, steps are now being taken to use X-ray machines to search for blow-holes in machine castings whenever it is suspected that high reluctance in the magnetic circuit is causing brush trouble.



BLOW-HOLES REDUCE CROSS-SECTION OF MAGNETIC CIRCUIT

Causes of Joint Failure Pointed Out to Splicers

All employees in the splicing division of the underground department of the United Electric Light & Power Company, New York City, are instructed periodically in the proper method of making joints in high-voltage and low-voltage cables. A school for this purpose has been established in the company's 187th Street substation. The instructor in charge, an experienced cable splicer, is particularly well acquainted with the practical difficulties which are experienced in jointing cables in cramped quarters. Splicers with their helpers, including even those who have been with the company for a long time, are required to report for periodic instructions on methods of jointing and insulating conductors as prescribed by the engineering department of the company.

Before new employees are assigned as helpers in the splicing division they are instructed in removing lead sheathing and insulation, tinning bare conductors and sweating copper connectors thereto, insulating joints with tape and impregnating them with compound, arranging the mica tubes, dressing down and wiping lead sleeves, and filling the latter with insulating compound. Following this, the student is allowed to make a joint with the instructor looking on. If any errors are observed during the operations, the student is advised of his mistake and shown how to correct it. After the joint is completed it is cut open for examination. Many times the final inspections indicate methods of improving joints.

It has been found that if conductors are not properly aligned insulating compound on one side of the lead sleeve will be exceedingly thin, while on the opposite side it will be unnecessarily thick. Joints constructed in this manner and subjected to a high-voltage test will usually show a low break-down value owing to the thin insulation. To prevent such construction lead sleeves of larger diameter have to be employed usually, and the conductors must be carefully aligned.

Students almost invariably fail to remove the small needle points of solder which collect on copper conductors during sweating. As these projections offer excellent points for static discharge, they may eventually cause the insulation to break down. If all sharp edges and points are removed from the joint, however, before insulating with tape, this trouble will be prevented.

Entrapped air is one of the most frequent causes of joints having low break-down values. In a number of joints that failed it was found that the break-down occurred at the ends of copper connectors where air was pocketed by tape covering the space between the connectors and the conductor insulation. If these gaps had been properly filled with insulating compound, the fault would probably not have occurred. Another fault which has been observed is that energy leaked from the copper connector along the paper insulation of the conductors, following a zigzag path from layer to layer and terminating at the lead sheathing.

INSTRUCTING MEN IN MAKING JOINTS

To remove air which may penetrate the paper insulation and collect between the layers of tape and also in the compound poured inside the lead sleeve, the United Electric Light & Power Company is developing

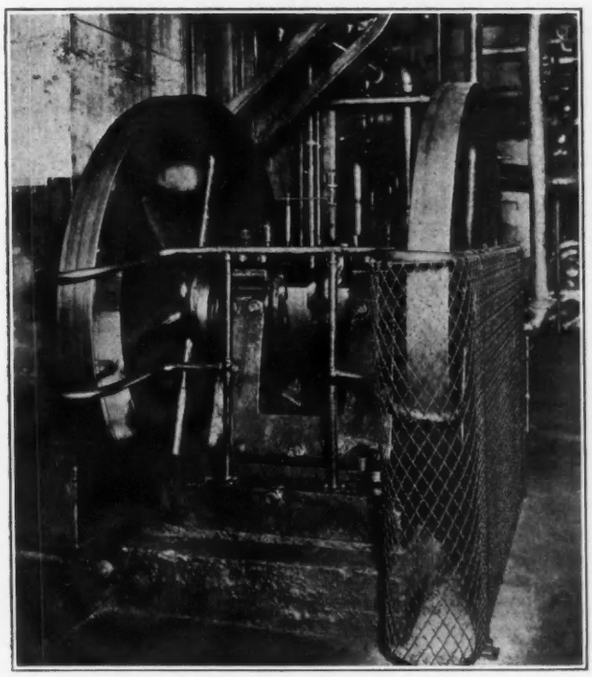
apparatus for producing a vacuum around the joint while compound is being poured. According to reports from the company, the preliminary training given employees of the splicing division has assisted considerably in the prevention of faults on the system due to defective joints.

Asbestos Lining for Industrial-Railway Coal and Ash Cars

One-half of the wooden-bodied cars used in the industrial-railway coal and ash handling system of a southern Indiana power-house are lined with asbestos board and sheet iron. The lined cars are used principally for hauling ashes, because sometimes ash handlers do not carefully extinguish all of the live coals and it was discovered that much of the wear of the wooden car bodies was due to burning and charring. Now, however, with the asbestos board between the wood and the sheet-iron lining, the life of a car body is found to be increased several-fold.

Preventing Recurrence of Accidents

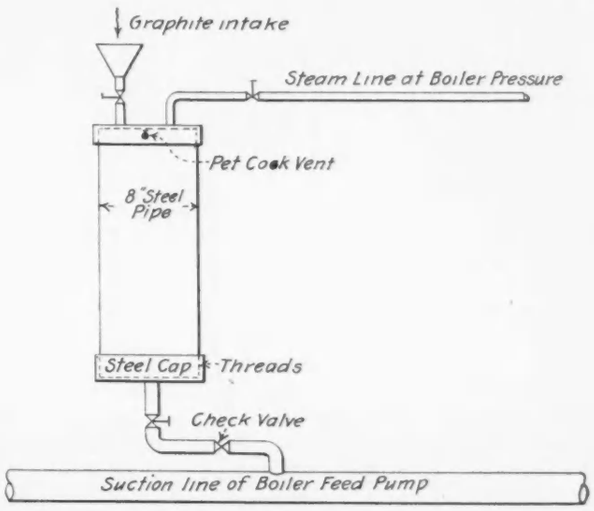
Frequently it happens that the occurrence of an accident calls attention to the lack of protection which had hitherto been considered unnecessary. Such was the case in one of the stations of the Edison Electric Illuminating Company of Brooklyn, where a flywheel attached to the shaft with a flush pin was allowed to rotate without protection. One day the station operator brushed past the end of the shaft and his coat was caught by the slightly projecting pin, throwing him forcibly to the floor. Although the man was not injured, the accident showed what might have happened, so all flywheels have been completely inclosed with a wire network, as shown in the accompanying illustration. All central-station operators might advantageously follow the example by inclosing the flywheels in their stations before the occurrence of a serious accident compels them to do so.



FLYWHEEL INCLOSED IN CAGE

Dispensing with the Unsightly Copper Oil Can

Cylinder lubricators on the engine-driven auxiliaries in the combination lighting and railway power plant of the Terre Haute, Indianapolis & Eastern Traction Company at Terre Haute, Ind., are all fed from a central oiling system. There are in the station seventeen duplex pumps, three single-acting pumps, four dry-vacuum pumps and four circulating pumps. On none of these units does the visitor to the station see a cylinder-oil can. Instead, however, he will observe small neatly installed pipe lines leading from an oil header to each cylinder lubricator or sight-feed oil dropper. Tracing the oil header back to its origin, there will be found a home-made 5-gal. steel tank



APPARATUS FOR FEEDING GRAPHITE TO AUXILIARIES

which, at all times except when it is being filled, is kept under 110 lb. pressure by live steam. The arrangement of the piping at the tank is shown in the accompanying sketch. Mr. H. E. Smith, chief engineer at the plant, designed the oil system to reduce the waste of oil and the inconvenience of filling such a large number of lubricators. According to his statement, the apparatus has not only proved entirely successful from the standpoints of economy and convenience, but has aided greatly in keeping the station auxiliaries "looking spick and span."

Locating Overloaded Sections in a Central-Heating System

BY H. A. WOODWORTH

One of the perplexing difficulties which confront the heating engineer of a hot-water central station is that of determining just which sections of his heating mains are most in need of renewal. To maintain uniformly good service it is necessary for the engineer to discover the location of the "weak points" or the overloaded sections of his piping system, if such places exist, and then to renew and increase the size of the mains and laterals to relieve such inefficient operating conditions.

Engineers of the Merchants' Heat & Light Company at Indianapolis, Ind., have been, during the last heating season, engaged in making an extended series of tests to determine whether or not any part of the hot-water heating system in that city needed rehabilitation. The procedure of the tests was as follows:

While constant pressure was maintained on the system observers equipped with stop-watches and ther-

mometers were stationed at the plant, at the end of the main trunk lines about 800 ft. from the plant, and at the ends of laterals about 3000 ft. from the trunk line. With these watchers in readiness fires under the circulating boilers were all dropped simultaneously at a prearranged time. Immediately afterward the fires were replaced and forced skilfully to bring the water temperature back to normal. The observers at various points on the system, by taking simultaneous time and temperature readings, noted the fall in temperature as the cooler water passed their respective stations and also noted the time interval that elapsed before the temperature was restored to normal again. With the distance between the stations known it required but a few simple calculations to obtain the speed of the water in the mains and the line losses in degrees Fahrenheit occurring between the power plant and the point of reading.

Curves to Indicate Line Losses

Plotting time as ordinates and temperature as abscissas from the data obtained, a curve was produced in which the passage of the cooler water was clearly shown by a dip in an otherwise comparatively straight line. Near the station the readings showed the dip to be very pronounced, but further out on the system it became more shallow. The difference in the depths of these dips gave an indication of the line losses on the mains and laterals, while the velocity of the water was taken as the most definite indication of the loaded condition of the piping, high velocity indicating heavy loading and low velocity light loading. Considering velocities of 4 ft. per second in mains and 3 ft. per second in laterals as the maxima allowable, test data which have just been compiled show conclusively that almost the entire system is in good operating condition, although the lines were laid fourteen years ago and, according to some theories of depreciation, should now be ready for replacement.

In connection with these tests, readings were also taken on all lines to determine the difference between the flow pressure and the return pressure. In considering future loading of the lines this pressure data will also be of value as it is considered inadvisable to add customers to a line which has a differential pressure of less than 1 lb. per square inch.

Direct-Current Hoist Equipment in Industrial Plants

Control of direct-current hoists in industrial plants and steel mills was one of the principal topics of discussion before the recent Pittsburgh industrial-power meeting of the American Institute of Electrical Engineers.

Messrs. G. E. Stoltz and W. O. Lunn, in a paper on "Control of Direct-Current Hoists in Iron and Steel Mills," confined their discussion to a typical example of a skip hoist. The load is divided into three parts, namely: Friction, inertia of the moving parts, and useful work in hoisting the net load. The normal operation of the hoist described is hoisting first two loads of coke, net weight 3000 lb. each; then two loads of limestone, 3000 lb. each; two more loads of coke and finally four loads of ore, 6000 lb. each. The number of accelerating points required will be determined by the maximum current peaks possible, six switches usually giving satisfactory results on hoists of this character with motors of 100 hp to 200 hp. Series-wound switches may be used for all but the last accelerating notch, which should be a shunt switch or its equivalent. The operation of the hoist mentioned was described in detail in the paper, and a number of illustrations were printed.

Choice of a Controller

In his paper on "Direct-Current Control for Hoisting Equipment in Industrial Plants," Mr. W. T. Snyder pointed out that in making the selections of a controller for a particular application all conditions must be considered, such as the type of operator, conditions under which motor will be installed, operated and maintained, the relative importance of such factors as reliability, simplicity, cost of repairs and maintenance, and initial cost, adding that the order of importance of these items will be different for different applications. For applications like blast-furnace skip hoists reliability and continuity of operation are of first importance, while initial cost should be a last consideration. Under conditions similar to those in high-speed coal hoists where an ordinary delay does not affect plant operation and where the operator can also take care of all ordinary repairs and maintenance of the electrical equipment the question of simplicity, repairs and maintenance, and initial cost, should receive most consideration. Applications similar to the slow-speed ash hoist which is operated by unskilled labor require that the controller perform its functions positively and accurately and have all protective features necessary to avoid damage to the apparatus it controls. Where the controller is designed for automatic acceleration, to provide against accelerating switches failing to close and leaving part of resistance in circuit, and on manually operated controllers where the accelerating period represents 10 per cent or more of the complete operating cycle, the resistor should have a carrying capacity equal to that of its motor with a maximum temperature rise of 50 deg. C. Protective resistance in series with magnetic switches is a possible source of trouble which should, when practicable, be avoided. Generally speaking, manually operated controllers for service above 25-hp rating should not be used on hoisting equipment.

Discussion

Mr. H. D. James stated that the theoretical calculations in connection with the arcing of electric switches are difficult, owing to the many elements which enter into the problem, yet this arcing is the most important factor that has to do with the maintenance of the electric contactor. The objection to an oil-break switch lies in the inaccessibility of the parts submerged in oil.

Mr. W. C. Kennedy said that the most essential thing in blast-furnace operation is continuity of service.

Mr. E. H. Martindale stated that the manufacturers have found cast iron to be the best available material for grids, and mica to be the best substance for insulation.

Mr. J. W. Welsh suggested that the multiplicity of automatic and protective devices now in use may make it necessary to supplement these by something more simple with the purpose of insuring their satisfactory operation.

Mr. C. A. Dauler observed that a selective speed controller is no improvement on a two-point series switch controller for bridge travel.

Mr. Francis J. Burd spoke of the limit switches as being a very important part of the equipment. He believed that the limit switches, which should be positively connected mechanically to the winding drum and contacts, ought to be made double-pole and should be of the air-break type.

COMMERCIAL SECTION

"HOME ELECTRICAL" AT SAN FRANCISCO

Attractive Dwelling at Exposition Serves as Setting for Complete Operative Exhibit of Domestic Electrical Devices and Equipment

One of the most carefully planned and attractive exhibits at the Panama-Pacific International Exposition at San Francisco is the "Home Electrical" in the Manufacturers' Building. In this model dwelling electricity is made to cook, wash, launder, sweep, dust and perform countless other domestic duties, as well as heat, light, and even cool the house.

In no sense a mere exhibition "stunt" for demonstrating the possibilities of unrelated electrical equipment, the "Home Electrical" is, on the contrary, in

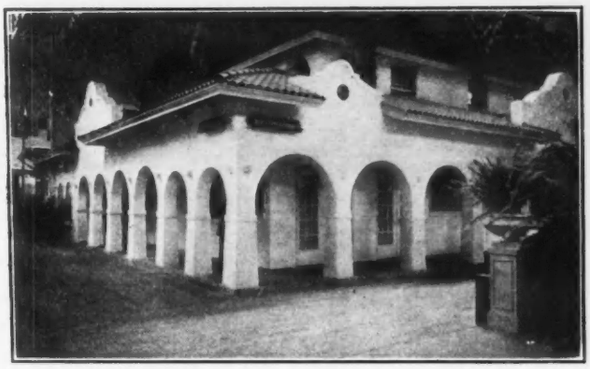


FIG. 1—THE MODEL HOME WHICH SHOWS EXPOSITION VISITORS HOW ELECTRICITY CAN LIGHTEN THE HOUSEWIFE'S LABORS

every way a practical modern home; hence, not a single electrical convenience is shown which would not be entirely suitable for the average family and well within the means of a man of moderate income.

The structure is of simple Spanish-California mission-bungalow design, and inexpensive in cost. Its exterior is of gray stucco, with a long columned portico on two sides, and the roof is of red tile. The interior includes a large living-room, a dining-room with a breakfast alcove, a bedroom, nursery, sewing-

FIG. 2—THE "ELECTRIC LOGS" IN THE LIVING ROOM, AND A GLIMPSE OF THE ELECTRICAL DINNER WAITING FOR SOMEONE TO TURN THE SWITCH

room, bath, kitchen, refrigerator room and laundry. In addition, there is also an electric garage, a workshop and a small creamery.

An electric piano player is the attraction in the living room, where deep armchairs are comfortably placed in front of the electrical "fireplace." The lighting here is furnished by tungsten lamps in semi-indirect fixtures.

FIG. 3—NO ELECTRICAL CONVENIENCE IS LACKING IN THIS ATTRACTIVE BEDROOM

Adjoining is the dining-room with its dainty tinted shades. The table is set, and on it are cooking devices ready for the preparation of a light lunch, although, if desired, a very substantial meal can be cooked on the dining-room table. To the right, behind a wooden screen and alongside the French windows which open to a little vine-covered patio, is the "breakfast nook," also equipped for table cooking.

Leading to the kitchen is the butler's pantry, which is equipped with a warming closet for keeping the food

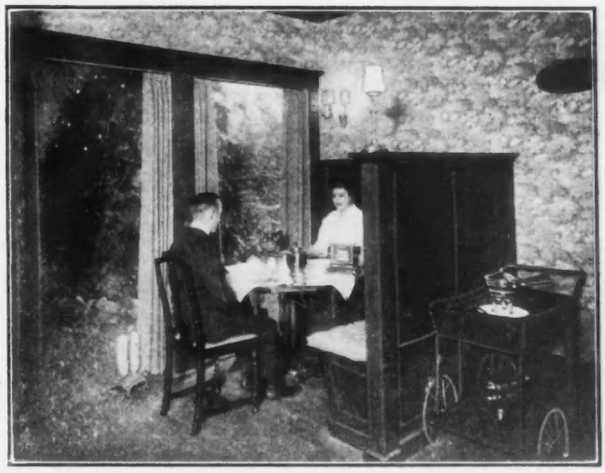


FIG. 4—AMID SURROUNDINGS LIKE THESE EVEN DYSPEPTICS YEARN FOR BREAKFAST

hot between courses, a dishwasher, a disk stove for making dressing and sauces, and a small electrically driven buffer for the silver.

In the kitchen electricity finds its greatest field of usefulness. An electric range, equipped with hotplates, broiler and ovens, is ready to cook the largest family dinner. A constant supply of hot water is assured by an electric heater attached to the usual kitchen water tank. Odors of cooking are removed by the combination of an ozonator and an exhaust fan. The elec-

trically cooled refrigerator, the electrically driven ice-cream freezer, and, finally, the inter-house telephone service, are special features which combine to excite the envy of the fair visitor.

The bedroom is equipped with all those small devices so dear to a woman's heart. Most interesting to the timid visitor, perhaps, is the burglar switch, which, when touched, lights every lamp in the house. Near the bedroom is the nursery with its electric toys and an electrical device at the window to keep the room supplied with fresh air without dangerous drafts. The room is heated by electricity and contains an electric nursery outfit for preparing medicine, food, etc., in case of sickness.

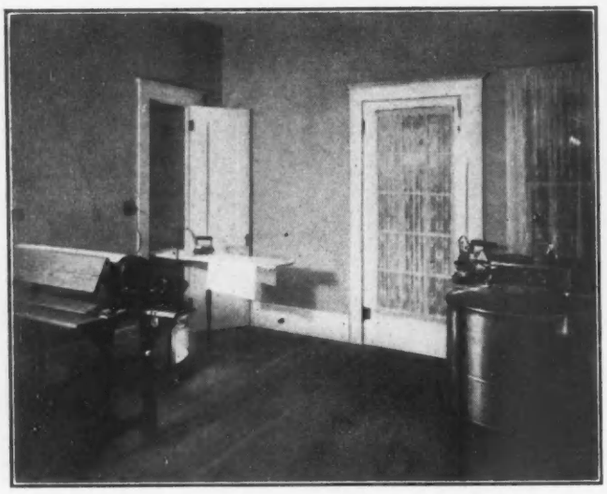


FIG. 5—MONDAY BACKACHES AND TUESDAY DRUDGERY ARE BANISHED FROM THIS SPOTLESS LAUNDRY

The sewing-room commands its share of feminine attention, for here there is a sewing machine operated by an electric motor controlled from the foot treadle. A small portable vacuum cleaner near by picks up threads and scraps of cloth without effort.

An important adjunct of the home is a complete electrical laundry, containing a quiet-running washing machine, an electric mangle, flatirons and a double 8-in. hot-plate for boiling the clothes. An air heater and exhaust fan provide comfortable working temperatures under all weather conditions.

FIG. 6—THE COOK'S WORKSHOP, WHERE CLEANLINESS, CONVENIENCE AND EFFICIENCY PREVAIL

The workshop for the man of the house has numerous small-motor conveniences, chief among which are the bench-type drill press, chipping hammer, electric riveter and grindstone. Completing the equipment, there are a buffing outfit, saw tables, bench-type lathe, metal melting pot, handy little electric soldering irons, and an electric glue-pot for repairing leaky utensils or broken woodwork.

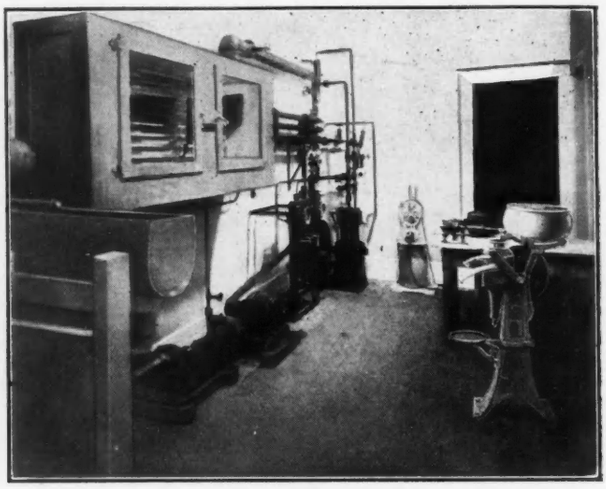


FIG. 7—THE ICELESS REFRIGERATOR AND THE MOTOR-DRIVEN DAIRY MACHINES

This exhibit, which is conducted by the General Electric Company, is co-operative to the extent that it includes a very comprehensive display of general domestic devices, which, although operated by the company's motors, are themselves the products of other manufacturers.

The Importance of Having a Policy and Maintaining It

"I believe there can be no satisfactory relations between a producer and a distributer unless each has a definite policy," said Mr. H. B. Crouse, president of the Crouse-Hinds Company, Syracuse, N. Y., in an address before the Electrical Supply Jobbers' Association at Chicago, March 18.

"A definite policy," continued Mr. Crouse, "is a prearranged plan of action, carefully thought out and rigidly maintained in the belief that at the end of any definite period of time the best aggregate results will have accrued.

Establishing a Policy, and Ultimate Success

"A man or a business house without some resources cannot expect to have and to maintain a definite policy, because usually a policy will not begin to 'cash in' for you immediately, and if you must have your money Saturday night you need not spend much time or thought outlining, establishing and maintaining a policy.

"Some individuals and some concerns in the electrical industry—as in all industries—never can and never will have a policy, and therefore, I believe, never can be really successful. Some individuals and some concerns are not so good in outlining and establishing policies as are other individuals and concerns, but I have hope for these if they continue in their efforts."

Arbitrary Limits and Their Enforcement

"Every policy must be bounded by arbitrary lines," said the speaker later in his address, "but such lines appear arbitrary only as they are approached, and even the maker of the policy must admit that such a line appears absolutely arbitrary when it is reached. But

this must be so if the policy is to be maintained—and no policy is of value unless it is maintained.

"The arbitrary boundary lines of a policy should not be made of rubber. If it be decided to make these lines so that they will stretch, nothing is gained, because even though one makes the arbitrary lines flexible, it will then be necessary to decide how flexible they are to be, and the final result will be that again an arbitrary line must be taken."

Difficulties and Temptations That Lie in the Way

"Some of the policies which have proved to be the most successful really caused the most trouble while they were being established," said Mr. Crouse. "If there is any one common mistake that a business man makes in connection with having a policy, it is that he gets scared out before he has had the policy in effect long enough to find whether it is good or bad."

"Having a policy and standing by it are not always easy," said the speaker in closing. "Temptations are numerous and powerful; in fact, when it comes to the matter of maintaining a policy, one is almost daily tempted to break it, and if one has the nerve to resist the temptations continually he may come to the conclusion that he is a pretty good loser. Unless a man is willing to be a good loser when necessary, he cannot maintain a policy."

Too Large Motor Not Economical

Not agreeing with a representative of the Philadelphia Electric Company on the size of a motor required to perform a definite duty, a consumer decided to install a machine rated at one and one-half times the one recommended. On receiving his monthly bill, which was based on the horse-power rating, however, he was greatly disappointed to find the amount he owed larger than expected. A test was made, and the fact was brought out that the rating which had been recommended by the representative was correct. The proper motor was finally installed, and subsequent bills dropped 33 1/3 per cent below the first one.

Electric "Town Clock" on Chicago's Lake Front

"The largest motograph sign in the world," which stands at the head of Michigan Avenue, Chicago, has now been made more useful and more attractive than ever by the addition of an electric numeral clock, the

FIG. 1—MOTOGRAPH SIGN IN OPERATION

figures of which are visible for 2 miles along the lake-front boulevard. Electrical and mechanical interconnections are so arranged that the time monograms are flashed in the intervals between the motograph sentences. The time, corrected to within one second by Western Union telegraph, is thus given to the public two or three times each minute. The motograph portion of the sign, which carries advertising of the Commonwealth Edison Company and other firms, is operated only between dusk and midnight, but the clock portion of the sign is operated from early afternoon until morning.

FIG. 2—FLASHING THE TIME TO CHICAGO

The inscription "Ye Town Clock" in 20-ft. letters, containing 1000 15-watt lamps, was also added, and is flashed alternately with the original legend at the top of the sign reading "America's Leaders." The clock inscription always appears, however, simultaneously with the time monograms. This motograph sign is operated by the Federal Sign System (Electric), and the mechanism of the motograph part was described in detail in the ELECTRICAL WORLD of Oct. 17, 1914.

Data on Electric Service to Iowa Farms

Reports on rural electric-service business in Iowa collected by Mr. W. H. Burtis, of Decorah, Ia., indicate a consensus of opinion among Iowa central-station men to the effect that a line to serve farmers should be built when investigation shows that such a line will be a paying investment almost from the beginning. The cost of line construction should be borne by the farmers, but the completed line should be owned and maintained by the company. Transformers and lightning arresters, according to Mr. Burtis, should be furnished by the company. Separate meters for light, motor service and cooking were favored, and although it is thought best to charge the same energy rates in the country as in town it was generally agreed that rural customers' minimum charges should be higher than those for city customers.

The answers to the following questions submitted by Mr. Burtis show how widely rural practice differs among Iowa companies:

"What is your minimum charge for rural service?" Answers to this question showed minimum charges ranging from 40 cents to $5 a month.

"Do you sell energy for lighting, cooking and motor service on separate meters?" Nearly all answers to this question favored separate meters.

"What voltage do you use for operating rural transmission lines?" Answers showed that ten potentials, ranging from 33,000 volts to 1100 volts, were used by thirty-three companies.

"Do you advise groups of prospective farm customers to incorporate and operate their lines, paying the company for the energy as recorded by a single primary meter?" About one-half of the operators answering were in favor of dealing with incorporated groups.

"Do you require farmers to pay bills once a month

or once in three months?" A large majority—that is, eighteen out of twenty-three—favored monthly settlements.

"Give any data you may have on energy used per customer per month." Fourteen answers showed that the Iowa farmer averages 47 kw-hr. a month.

"What is the average transformer loss on your rural lines as compared with the average energy consumption?" The six answers given ranged from 5 per cent to 75 per cent.

Electric Cooking as Off-Peak Load in Iowa

The interest with which central-station managers regard electric cooking was strikingly shown several times in papers and discussions before the Iowa Section of the National Electric Light Association at Keokuk, April 20 to 22. Mr. Edward Soukup, new-business manager of the Iowa Railway & Light Company, Cedar Rapids, brought up the subject in his paper on "Power Development Methods," stating that during the two years in which his company had supplied energy to four 2300-watt stoves the customers' bills for cooking averaged 75 kw-hr. per month at a 4.5-cent rate.

Mr. Kenneth Lindsay, manager of the Wapsie Power & Light Company of Mount Vernon, installed a number of ranges last year, and his records show that customer's total energy consumption averages 140 kw-hr. a month. This figure includes, however, energy used by washing machines and irons, and it is estimated that for cooking alone the average customer uses 130 kw-hr.

Discussion occasioned by queries on electric cooking in the "Question Box" brought out the fact that nearly every plant represented at the meeting is now experimenting to a greater or less extent with electric ranges. Bills for cooking service range from $3 to $16 a month. Mr. A. L. Dodd, of Charles City, expressed the opinion that within the next four years electric cooking will be a really formidable competitor of gas. Electric companies ought to make a cooking rate of not more than 4 cents per kw-hr., because very little of the cooking load, declared Mr. Dodd, is of on-peak character.

Iowa Central-Station Facts and Factors

Statistics on the operation of sixty-four Iowa central stations during the year 1914 were presented before the convention of the Iowa Section of the National Electric Light Association, at Keokuk, April 21. Of this total number fifty-one of the companies listed are privately owned and thirteen are municipally owned. As is customary in this annual report of the facts and factors committee, the stations are grouped according to the population served, and averages for each group were presented for the year just past and for the four years preceding it. Corresponding statistics for the years 1909 to 1914 will be found in the ELECTRICAL WORLD of May 9, 1914. In the table of grand averages herewith it is interesting to note that, while in five years the investment per capita has increased from $9.60 to $18.52, the gross income per capita has not increased proportionately, but has grown gradually from $3.93 to $6.19. The increase in income per capita during the last year, however, has been marked in spite of the prevailing industrial depression and in spite of the fact that the increase in investment per capita during that time was only 7 cents, an amount quite negligible.

The committee on facts and factors consists of Messrs. Austin Burt, of Waterloo; F. A. Fish, of Ames, and H. W. Wagner, of Ames. This year the facts and factors report was printed by the Iowa Engineering Experimental Station as a supplement to Bulletin No. 38.

TABLE I—CENTRAL-STATION STATISTICS FOR THE STATE OF IOWA

MUNICIPAL STATIONS

Station Number	Population of District	Number Consumers per 100 Population	Station Rating, Kw	Station Rating per Capita, Watts	Station Rating per Employee, Kw	Ratio Station Rating to Connected Load, per Cent	Average Load During Operation, Kw	Ratio of Average Load to Station Rating, per Cent	Annual Load-Factor, per Cent	Operating Load-Factor, per Cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per $100 Invested	Gross Income per Kw-hr. Made, Cents	Ratio, Expense to Gross Income, per Cent	Earnings from Operation per $100 Invested, Interest and Depreciation Not Deducted	Total Hours of Operation per Year
Factor No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
52	600	16.7	22	37	22	45	10.2	45.3	17.8	56.6	356	13.33	80.00	18.00	3.00	22.50	6.4	61.2	8.75	2750
53	800	11.2	60	75	60	..	5.8	9.7	....	....	200	15.00	43.30	28.90	3.25	21.70	10.2	75.0	5.38	4340
54	900	19.1	70	78	35	..	....	....	....	....	221	17.22	60.00	24.40	4.67	27.10	....	93.6	1.74	7202
55	1100	14.5	95	86	32	127	8.2	8.6	15.9	19.5	189	16.36	53.40	31.70	4.60	28.10	8.7	65.7	9.67	7116
56	1800	15.3	210	117	52	..	25.3	12.0	31.2	31.6	95	11.10	58.40	44.60	6.82	61.40	5.6	88.3	7.21	8645
57	2000	20.2	135	67	22	..	....	....	....	....	237	16.00	108.00	36.00	7.30	45.60	....	70.7	13.38	8670
58	2060	29.6	160	78	40	84	14.6	9.1	13.7	14.0	156	12.13	78.10	20.50	6.07	50.00	10.0	62.4	18.80	8560
59	2500	12.0	300	120	75	250	6.9	2.3	7.7	7.7	73	8.80	34.50	34.50	4.14	47.10	17.1	92.8	3.42	8760
60	2500	23.2	150	60	37	..	36.1	24.1	24.1	24.1	279	16.72	132.50	34.30	7.95	47.60	6.3	48.5	24.50	8760
61	3000	17.7	260	87	65	..	....	....	....	....	115	10.00	53.80	26.40	4.67	46.70	....	71.4	13.33	8360
62	3900	20.2	350	90	50	88	41.8	11.9	24.3	25.0	100	9.00	52.90	23.50	4.74	52.80	5.2	77.2	12.15	8500
63	4500	21.1	500	111	83	..	90.3	18.1	26.0	26.0	150	16.67	71.40	37.60	7.93	47.60	4.5	55.2	21.30	8759
64	7000	17.0	500	71	55	20	84.5	16.9	39.3	39.3	173	12.36	72.00	30.20	5.14	41.60	4.9	39.4	25.20	8760
Average 1915	2513	18.3	216	83	48	102	32.4	15.8	22.2	27.1	180	13.44	69.10	30.05	5.40	41.50	7.9	69.3	12.68	7629
Average 1914	2640	16.0	177	65	36	86	33.7	21.4	21.8	29.6	219	12.37	97.11	31.45	5.13	43.53	8.5	71.1	12.16	6590

TABLE III—ADDITIONAL AVERAGE FACTORS FOR PLANTS APPEARING IN ACCOMPANYING TABLES

	Kilowatt-hours Made Annually per Capita	Kilowatt-hours Made Annually per Consumer	Expenses per Kilowatt-Hour Made, Cents
Group I, 1915	67	332	7.4
Group II, 1915	92	538	5.7
Group III, 1915	118	679	4.1
Group IV, 1915	139	1110	2.8
Group V, 1915	167	1542	1.7
Grand average, 1915	159	933	4.8
Municipal, 1915	98	537	5.5

TABLE II—CENTRAL-STATION STATISTICS FOR THE STATE OF IOWA

COMMERCIAL STATIONS

	Station Number	Population of District	Number Consumers per 100 Population	Station Rating, Kw	Station Rating per Capita, Watts	Station Rating per Employee, Kw	Ratio Station Rating to Connected Load, per Cent	Average Load During Operation, Kw	Ratio of Average Load to Station Rating, per Cent	Annual Load-Factor, per Cent	Operating Load-Factor, per Cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per $100 Invested	Gross Income per Kw-hr. Made, Cents	Ratio, Expense to Gross Income, per Cent	Earnings from Operation per $100 Invested, Interest and Depreciation Not Deducted	Total Hours of Operation per Year
	Factor No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
GROUP I	1	340	13.0	20	59	20	133	2.5	12.6	11.5	20.0	$200	$11.75	$66.70	$30.30	$ 3.92	$33.30	10.5	129.0	−$9.52*	5050
	2	450	33.3	35	78	35	87	.....	.....	.....	.....	114	8.90	85.70	20.00	6.67	75.00	.....	80.0	15.00	2190
	3	500	24.0	25	50	12	38	3.8	15.1	15.1	15.1	200	10.00	120.00	25.00	6.00	60.00	9.1	73.3	16.00	8760
	4	500	20.2	22	44	11	.....	.....	.....	.....	.....	381	16.80	119.50	26.00	5.26	31.30	.....	103.0	−0.95*	.....
	5	540	25.9	35	65	17	50	5.5	15.7	7.0	7.0	228	14.80	92.80	23.20	6.01	40.60	6.7	72.8	11.00	8760
	6	700	16.4	60	86	60	60	5.5	9.2	.....	.....	117	10.00	66.70	34.80	5.71	57.15	8.3	50.0	28.57	8760
	7	750	16.7	75	100	25	214	3.8	5.1	10.1	15.2	160	16.00	38.70	23.20	3.87	24.10	13.2	74.2	6.25	5840
	8	750	19.7	75	100	37	.....	14.4	19.2	.....	.....	179	17.85	74.50	37.70	7.45	41.70	8.1	118.3	−7.61*	4800
	9	800	12.5	22	28	22	55	11.4	51.8	14.8	57.0	454	12.50	159.00	35.00	4.38	35.00	13.5	51.4	17.00	2280
	10	1,000	20.0	80	80	40	59	9.0	11.2	17.3	22.5	187	15.00	86.50	34.60	6.92	46.10	11.4	74.8	11.63	6750
	11	1,000	20.5	90	90	90	.....	.....	.....	.....	.....	172	15.50	65.40	28.70	5.88	38.00	.....	58.3	15.85	8760
	12	1,200	18.6	75	62	25	125	.....	.....	.....	.....	160	10.00	84.40	28.40	5.26	52.60	.....	79.2	10.91	8460
	13	1,300	19.2	100	77	33	.....	.....	.....	.....	.....	250	19.23	91.00	36.40	7.00	36.40	.....	26.4	26.80	6570
	14	1,340	9.9	135	101	45	90	5.7	4.2	.....	.....	48	4.85	25.90	26.30	2.61	53.85	7.0	78.5	11.55	8760
	15	1,400	17.9	120	86	40	133	8.7	7.3	10.9	14.5	83	7.15	50.00	24.00	4.28	60.00	10.5	83.3	10.00	6570
	16	1,450	31.4	130	90	33	.....	.....	.....	.....	.....	130	11.70	101.00	28.90	9.07	77.40	.....	88.7	8.82	8760
	17	1,500	17.3	90	60	15	45	18.1	20.1	23.6	35.0	144	8.70	91.40	31.80	5.48	63.30	7.7	83.7	10.40	5910
	18	1,500	13.9	115	77	38	48	16.0	13.9	29.8	34.0	200	15.35	62.80	34.80	4.82	31.40	5.9	76.7	7.35	7680
	19	1,500	26.7	125	83	25	36	.....	.....	.....	.....	200	16.70	128.00	40.00	10.66	64.00	.....	87.5	8.00	8700
	20	1,600	23.7	115	72	29	70	13.0	11.3	13.3	13.7	225	16.30	117.30	35.60	8.43	51.90	12.2	74.0	13.65	8500
	21	1,700	20.6	175	103	58	67	23.0	13.1	26.4	33.0	135	13.90	67.40	33.70	6.95	50.00	7.3	83.4	8.35	7000
Average 1915		1,040	20.1	82	76	34	82	10.0	15.0	16.3	24.3	189	13.00	85.40	30.40	6.03	48.74	9.4	78.4	10.46	6943
Average 1914		1,290	15.9	86	67	34	70	17.0	20.3	19.8	32.6	219	13.15	93.70	34.70	5.35	42.80	10.3	75.8	11.06	5960
GROUP II	22	2,200	.....	150	68	37	67	30.0	20.0	33.0	33.0	100	6.82	90.90	.....	6.20	90.90	5.2	73.3	24.25	8760
	23	2,300	13.1	180	78	60	75	10.6	5.9	11.2	11.5	222	17.40	79.40	47.40	6.22	35.70	15.9	49.1	18.20	8520
	24	2,300	17.8	140	61	35	38	21.4	15.3	22.5	23.8	178	10.90	110.80	37.80	6.74	62.00	8.8	77.5	14.00	8260
	25	2,500	15.2	150	60	21	38	25.7	17.1	28.5	28.5	400	24.00	120.00	47.40	7.20	30.00	8.0	75.0	7.50	8760
	26	2,900	15.7	190	65	38	26	14.9	7.8	15.0	15.0	225	14.74	62.40	26.00	4.09	27.70	9.1	63.7	10.05	8760
	27	3,000	22.5	225	75	45	80	13.5	6.0	15.0	15.0	209	15.70	83.60	27.90	6.26	40.00	15.9	66.9	13.26	8760
	28	3,000	11.7	400	133	80	.....	.....	.....	.....	.....	90	12.00	45.00	51.40	6.00	50.00	.....	50.0	25.00	8760
	29	3,000	21.9	160	53	27	.....	41.7	26.0	27.8	27.8	250	13.30	126.20	30.80	6.73	50.50	5.5	59.5	20.50	8760
	30	3,000	17.7	335	112	56	84	62.0	18.5	33.8	34.4	105	11.67	48.10	30.40	5.37	46.10	3.0	66.0	15.65	8600
	31	3,000	18.5	150	50	30	54	40.8	27.2	27.2	28.6	300	15.00	140.00	37.80	7.00	46.70	6.2	80.9	8.90	8350
Average 1915		2,720	17.1	208	75	43	58	29.0	16.0	23.8	24.2	208	14.15	90.64	37.43	6.18	47.96	8.6	66.2	15.73	8629
Average 1914		2,640	16.9	154	58	32	34	28.2	19.6	26.7	27.0	238	13.77	101.90	33.80	5.67	44.00	6.8	72.6	12.40	8620
GROUP III	32	4,000	21.3	300	75	33	50	58.0	19.3	18.2	19.0	150	11.25	100.00	35.20	7.50	66.70	6.2	62.5	25.00	8400
	33	4,000	19.0	300	75	33	62	41.7	13.9	18.9	19.0	250	18.75	101.00	39.80	7.57	40.40	8.3	86.6	5.43	8736
	34	5,000	14.7	210	42	21	....	71.7	34.2	.....	.....	524	22.00	153.80	44.00	6.46	29.40	5.1	40.0	17.60	8760
	35	5,000	14.6	365	73	46	76	30.8	8.5	24.0	24.0	167	12.20	64.60	32.30	4.72	38.70	8.7	58.1	16.15	8760
	36	5,000	17.2	510	102	32	64	110.0	21.6	31.4	31.4	372	38.00	84.00	50.00	8.57	22.50	4.4	56.2	9.88	8760
	37	5,450	23.1	200	37	40	79	73.8	36.9	44.1	44.6	.....	.....	169.50	27.00	6.22	.....	5.3	55.6	.....	8670
	38	7,700	15.0	550	71	24	44	128.0	23.3	25.0	25.0	452	19.20	55.80	26.60	3.99	20.70	2.7	73.0	5.61	8760
	39	7,800	14.0	500	64	33	83	82.2	16.4	23.4	23.4	200	12.80	120.00	55.00	7.70	60.00	8.3	100.0	0.00	8760
Average 1915		5,494	17.4	367	67	33	65	74.5	21.8	26.4	26.6	302	19.17	106.09	38.74	6.59	39.77	6.1	66.5	11.38	8701
Average 1914		5,680	14.5	489	87	47	45	67.4	14.5	23.2	23.5	261	21.30	80.10	41.50	5.94	34.10	7.2	66.1	11.59	8660
GROUP	40	10,000	7.3	900	90	112	76	92.0	10.2	27.9	27.9	183	16.50	41.60	51.00	3.74	22.70	4.6	71.5	6.45	8760
	41	10,000	15.0	950	95	63	....	137.0	14.4	25.8	25.8	380	36.10	82.60	52.20	7.84	21.70	6.5	36.8	13.73	8760
	42	11,400	16.3	1100	97	30	58	192.0	17.5	33.7	33.7	454	44.00	75.00	44.30	7.23	16.50	4.9	85.3	2.38	8760
	43	11,500	15.7	2000	174	74	133	228.5	11.4	41.5	41.5	357	62.10	41.60	46.30	7.24	11.70	4.2	49.4	5.91	8760
	44	12,000	13.3	750	63	29	.....	.....	.....	.....	.....	608	38.10	90.70	42.50	5.66	14.90	.....	53.0	7.00	8760
	45	16,200	7.6	1600	99	100	106	290.0	18.1	26.7	26.7	188	18.52	55.00	70.90	5.43	29.30	3.5	60.3	11.67	8760
Average 1915		11,850	12.5	1217	103	68	93	187.9	14.3	31.1	31.1	362	30.89	64.42	51.20	6.19	19.47	4.7	59.4	7.86	8760
Average 1914		12,690	12.5	1225	103	53	86	171.6	15.0	32.9	32.9	423	44.10	68.20	45.18	5.96	15.62	4.6	54.6	7.32	8760
GROUP V	46	25,000	10.4	1000	40	33	19	527.5	52.7	45.5	45.5	311	12.45	132.00	50.60	5.28	42.40	2.9	45.9	23.00	8760
	47	26,000	10.0	3050	118	160	102	405.5	13.3	19.3	19.3	163	19.15	42.40	49.70	4.97	26.00	3.6	40.5	15.50	8760
	48	36,000	12.0	4200	117	81	46	685.0	16.3	31.1	31.1	282	33.90	55.30	53.70	6.46	19.60	3.9	47.8	10.25	8760
	49	40,000	10.1	9500	238	158	154	987.5	10.4	29.0	29.0	126	30.00	25.00	58.50	5.94	19.80	2.7	40.0	11.89	8760
	50	45,000	13.7	3400	76	....	82	899.3	26.5	37.0	37.0	492	37.20	120.60	66.70	9.12	24.50	5.2	49.8	12.30	8760
	51	119,000	8.9	8500	71	46	42	2030.4	23.9	34.4	34.4	442	29.40	79.10	63.60	5.64	19.20	3.8	46.1	10.35	8760
Average 1915		48,500	10.8	4942	110	96	74	922.5	23.8	32.7	32.7	298	27.02	75.73	57.13	6.23	25.25	3.7	45.0	13.88	8760
Average 1914		46,830	9.5	4130	91	87	47	748.3	19.6	32.3	32.3	261	22.40	72.50	69.20	5.80	28.20	3.9	47.1	14.78	8760
Grand Average 1915		8,920	17.1	856	82	46	74	177.9	17.7	24.5	26.9	242	18.52	86.10	38.70	6.19	40.99	7.2	66.7	11.73	7998
Grand Average 1914		9,470	14.6	819	77	45	56	152.0	18.3	24.9	29.5	251	18.45	87.30	41.00	5.78	37.25	7.6	67.8	11.60	7610
Grand Average 1913		11,400	12.5	778	61	71	35	155.0	23.2	.....	29.3	255	14.23	93.50	49.90	5.74	50.60	8.2	63.6	19.00	6950
Grand Average 1911		14,920	10.6	576	64	51	72	117.0	22.0	.....	30.1	252	13.85	82.10	47.60	4.36	36.80	7.8	67.5	9.82	6770
Grand Average 1909		9,411	9.0	401	44	63	56	.....	.....	.....	32.0	220	9.60	89.50	46.00	3.93	41.60	.....	64.0	.....	.....

NEW APPARATUS AND APPLIANCES

Plug with Contact Strips Embedded in Narrow Slots

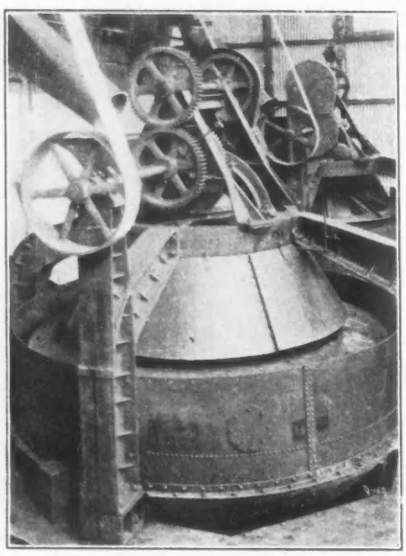
A sectional view of a plug recently developed by Harvey Hubbell, Inc., Bridgeport, Conn., is shown herewith. The contact strips are deeply embedded in narrow slots, thus eliminating, it is declared, the possibility of short-

SECTIONAL VIEW, SHOWING METHOD OF MAKING CONTACTS

circuits, accidental shocks, or arcing. Various types of interchangeable attachment plugs, wall plugs and flush receptacles made by the above manufacturer are being equipped with narrow slots and contact strips similar to those described above.

Centrifugal Coal Drier

In the accompanying illustration is shown a coal-drying machine which automatically retains the material for a definite predetermined time for drying. The machine consists of three main parts—the frame, a pair



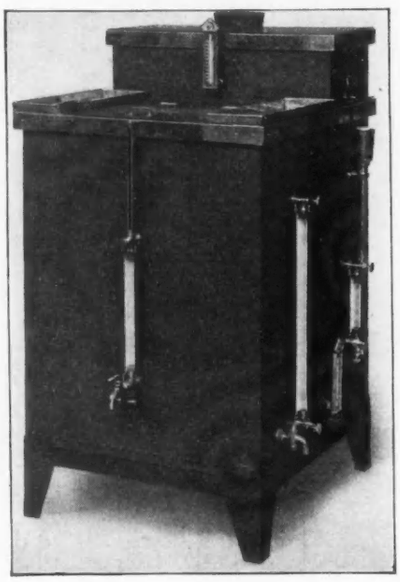
COAL-DRYING MACHINE

of feed spouts, and the container. There are also a discharge hopper for the dry coal and a sluice for the reclaimed water. The feed spouts are fastened to an inner solid shaft and are driven by suitable transmission so that they can revolve at any desired speed independently of the retainer. The retainer is a conical-shaped chamber, which is driven at a high rate of speed by a hollow shaft independently of the feed spouts. The outer inclined wall of the retainer is of perforated metal and the bottom is provided with openings which are closed by hinged doors. Outside the inclined wall is a sluice for carrying away the water.

The hinged doors are automatically opened and closed by a pair of cams attached to the shaft which carries the feed spouts. As the retainer slowly gains upon the cams, the difference in speed being very slight, the dried material is automatically discharged through the door openings, each door opening in its turn. As the door closes, the spout which follows directly behind the cam fills the empty place in the retainer. The coal drier is being made by the Link-Belt Company, Chicago, Ill.

Oil Filter

With an oil filter developed by the Richardson-Phenix Company, Milwaukee, Wis., the oil is first heated to lower its viscosity and reduce its ability to retain water,

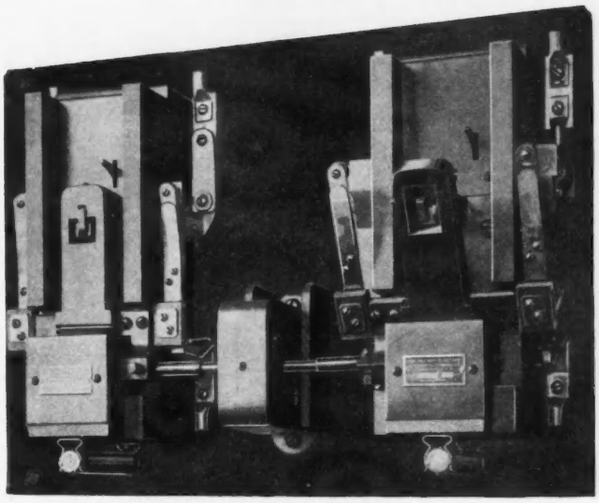


OIL FILTER WITH CAPACITY OF 100 GAL. TO 200 GAL. AN HOUR

then passed slowly over a series of shallow trays, and finally conveyed through a filtering medium. The separated water collects in the bottoms of the trays and is by-passed to the bottom of the precipitation compartment, where it is automatically ejected through an overflow pipe. From the top tray the oil flows into the filtering compartment, which contains nine non-collapsible filtering units. No oil can pass to the clean-oil compartment until the level in the filtering compartment reaches the outlet, and hence no filtering takes place until every square inch of cloth is submerged in oil. Gages are provided for observing the head of oil and the amount of water in the precipitation compartment. A thermometer indicates the temperature of the oil before it enters the precipitation compartment, and another shows the temperature of the oil in the clean-oil storage compartment. The filter body is of galvanized sheet steel and is reinforced with channel and angle iron. Filters with capacities of 100 gal. an hour to 7500 gal. an hour are being built.

Double-Throw Automatic Switch

A recent development in automatic switches, for use when two sources of energy are available, is illustrated herewith. The device consists of two magnet-operated switches with a mechanical interlock which prevents both switches being closed at the same time. The magnetic feature includes an automatic device which causes the opening of one switch and the closing of the other

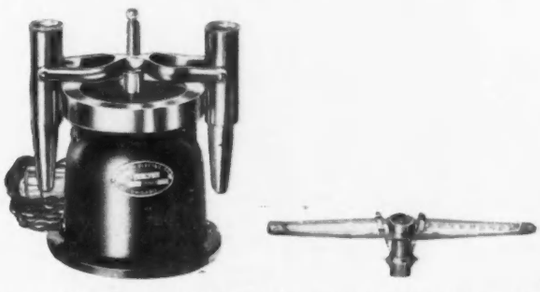


AUTOMATIC DOUBLE-THROW SWITCH

on a potential drop of predetermined value. The switch is normally connected with the preferred source of energy; the auxiliary system is thrown in upon the failure of the preferred source, and the normal connection is re-established when normal conditions again exist. When both circuits are de-energized, the switch is automatically connected to the one first available. The switch will operate on 600-volt circuits successfully, it is claimed, and will transfer the lighting load from the regular circuit to the auxiliary circuit so rapidly that the momentary interruption is not noticeable. The switch is being manufactured by the Palmer Electric & Manufacturing Company, Boston, Mass.

Electrically Operated Centrifuge

The small motor-driven centrifuge for laboratory work shown in Fig. 1 is compact and low-set, and is equipped with a weighted flywheel which serves to



FIGS. 1 AND 2—MOTOR-DRIVEN CENTRIFUGE AND DALAND HAEMATOKRIT

steady the action of the motor and to maintain a uniform but high speed. The inertia of the wheel causes the machine to start slowly, increasing its speed steadily without jerking. The wheel also causes the speed of the motor to decrease gradually after the circuit is opened. The centrifuge is provided with a two-arm sedimentation attachment and a speed controller. In Fig. 2 is shown a Daland haematokrit, which, when used with the centrifuge, is designed to enable one to count the number of red corpuscles in a certain amount of blood. The machine described has been developed by the Shelton Electric Company, 30 West Forty-second Street, New York.

Metal-Covered Cable for Automobile and Motor-Boat Use

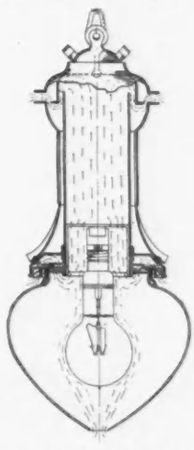
Cable covered with a flexible metal sheath, which is wound on in ribbon form, is being made by the Packard

FLEXIBLE METAL-COVERED CABLE FOR AUTOMOBILES AND MOTOR BOATS

Electric Company, Warren, Ohio, for use on automobiles and motor boats. The insulating material and braids are impregnated with enamel. The metal covering for the cable may be of nickel, brass or rust-proof steel. In the single-conductor type the cable is made in sizes ranging from No. 18 to No. 00 inclusive, and in the double-conductor type from No. 18 to 8 inclusive.

Converting Arc-Lamp Shells Into Containers for Nitrogen-Filled Units

A method for transforming arc-lamp fixtures into containers for nitrogen-filled lamps has been devised by



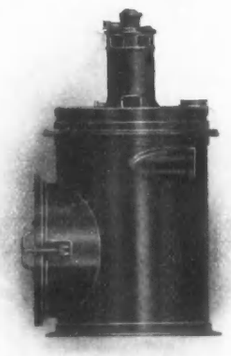
ARC LAMP CONVERTED INTO CONTAINER FOR NITROGEN-FILLED LAMP

the Metropolitan Engineering Company, Brooklyn, N. Y. Baffle plates are introduced in the housing to prevent the entrance of rain without hindering ventilation. Cold air enters from below, as shown in the accompanying diagram, becomes heated, and rises with considerable velocity. This in turn causes a stream of cold air to enter the inclosure from the side vent and

to impinge on the lamp base where the temperature tends to be highest. As a result, it is declared, the lamp base is at an even lower temperature than would be the case if the lamp were in the open atmosphere.

Motor-Driven Stationary Cleaner for Residences

A cleaner designed for use in dwelling houses and small apartment houses which are piped for vacuum-cleaning systems is being made by the Spencer Turbine Cleaner Company, Hartford, Conn. The cleaner, which



MOTOR-DRIVEN VACUUM CLEANER OF THE STATIONARY TYPE

is shown herewith, is usually placed in the basement and is operated by a Westinghouse universal motor, mounted on top of the machine. The separator is of the centrifugal type and is placed above the dirt pan, which is quite large. The machine is of steel, welded and riveted. The total height of the apparatus is 39.25 in. and the diameter 21 in. The height of the machine without the motor is 28 in.

Wiremen's Gasoline Torch

The gasoline torch illustrated herewith is provided with a corrugated goose-neck by means of which increased heating surface is provided and greater pressure is created, it is claimed, than could otherwise be produced. The tank is dome-shaped to avoid weakening the metal by bending it at a sharp angle, as would be the case were the top square. The bottom is concave and provides room for a clip which holds a reel of cleaning wire. The neck is screwed in by means of a wing nut, thus obviating the use of a wrench. The torch is started by holding a flame of any sort under the corrugated neck, thus vaporizing the gasoline in the wick. Within a few seconds the hissing of the gas is heard

WIREMAN'S GASOLINE BLOW-TORCH

as it makes its escape through the gasoline outlet, which is 0.009 in. in diameter, and the torch is then lighted. A removable perforated brass tube is attached to the goose-neck for concentrating the flame. According to the manufacturer, the Carleton Company, 170 Summer Street, Boston, Mass., the torch will burn two hours on one filling.

Mechanically Operated Fire Extinguisher

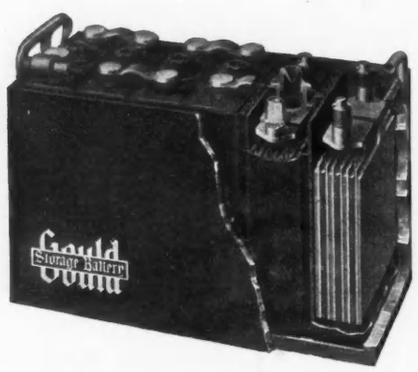
The fire extinguisher shown herewith is operated with one movement, the first turn of the crank automatically opening the nozzle, and is well adapted, the manufacturers claim, to put out electrical fires. The crank can be turned only in one direction. An indicator or gage

FIRE EXTINGUISHER

at the top of the device shows the fluid contents at all times. The liquid is forced from the machine by a plunger which is drawn forward by a cable wound around a drum connected to a gear shaft attached to the crank. The device holds one quart of fluid. Either a wall bracket or metal case may be employed, which can be fastened to the wall, or a bracket can be utilized for use with automobiles. The fire extinguisher is being placed on the market by the Justrite Manufacturing Company, Van Buren Street and Clinton Street, Chicago, Ill.

Storage Battery for Gasoline Automobiles

An improved battery for ignition, starting and lighting of gasoline automobiles has been developed by the Gould Storage Battery Company, 30 East Forty-second Street, New York. The active material in the positive



GASOLINE-AUTOMOBILE STORAGE BATTERY

plate is quite hard and is said to wear evenly; as a result, it is declared, a very uniform rating of the battery throughout the life of the plate is obtained. A large settling chamber is provided at the bottom of each jar, permitting long service without cleaning. Short-circuits between the plates are prevented by wide separation and by the use of rugged separators. The jars

are of heavy construction to prevent breakage from vibration. Use is made of a baffled splash plate as shown in the sectional view illustrated herewith. Where the pillar posts come through the cover sleeves of corrugated rubber surrounded with sealing compound are utilized. These posts are differently colored to enable the user to distinguish between the positive and negative terminals. A large expansion chamber with a threaded cap is employed for inspection and equalization of acid. Leakage up around the outside of the chamber is prevented by a rubber washer. Slopping over from the inside is prevented by the cap, which is in the form of an inverted cone. Inspection can be made by removing the vent cap, which may be used also as a funnel for pouring in water or acid without slopping or overflow.

Terminal Block for Connecting Lamp-Post Circuits to Underground Feeders

In the accompanying illustration is shown a terminal block with cover removed, which has been developed by the Colonial Sign & Insulator Company, Akron, Ohio,

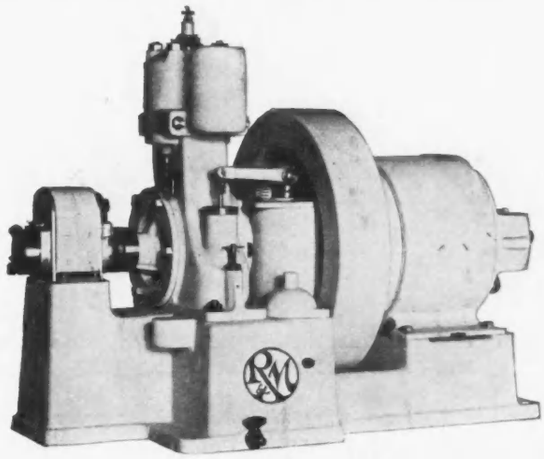
TERMINAL BLOCK IN LAMP-POST BASE

for which Verne W. Shear & Company of Akron are selling agents. The block is designed for installation in any standard-sized lamp-post base for connecting the lamp circuit to underground feeders. The block measures 5.25 in. by 3.625 in. by 2.25 in.

Small Lighting Generating Sets

In the gasoline-engine-operated generator outfit shown herewith the storage battery employed will alone deliver about 200 watts; when more energy is required the engine is automatically started (the generator acting as a motor until the engine comes up to speed) and continues to operate until the battery is completely recharged. In the event that more than 200 watts are being taken when the battery has become fully charged the controller opens the battery circuit and the engine continues to operate until the load is reduced below 200 watts. Two push-buttons are provided for starting and stopping the engine. The controller is designed to give the battery a so-called "overcharge" at every twelfth charge, to increase its life.

The engine is of the single-cylinder, two-stroke-cycle type, regulation being obtained by a throttling governor which holds the speed within 1.5 per cent above or below normal. Magnetic control of a float-feed valve is provided, by means of which the engine can be stopped from a distant location by a push-button. The generator for the type of set used without a battery operates at 115 volts, while that employed with the battery operates at 42 volts. The potential of the battery is 32 volts. The generators for both outfits are compound-wound. The battery consists of a 16-cell Hyray Exide battery and two counter cells. The sets are being



SMALL LIGHTING SET WITH ENGINE DIRECTLY CONNECTED TO GENERATOR

placed on the market by the Okey Manufacturing Company, Columbus, Ohio, and the generators are being made by the Robbins & Myers Company, Springfield, Ohio.

Horse-Driven Generator

In the article describing a generator operated by a horse which appeared in the ELECTRICAL WORLD of March 20, page 744, it was stated that the rating of the battery utilized with the generator is 16 amp-hr., which is an error. The rating of this battery is 60 amp-hr., and it operates at a pressure of 32 volts.

Improved Refillable Fuses

In the refillable fuses of the knife-blade type manufactured by the A. F. Daum Company, Pittsburgh, Pa.,

FIG. 1—REFILLABLE FUSE OF KNIFE-BLADE TYPE

use is now made of hard-copper blades with rounded edges which are cast into the brass cap. The fuse strip is so arranged that by removing longitudinal strips the

FIG. 2—REFILLABLE FUSE WITH WIRE FUSE ELEMENT

rating can be changed. Heretofore it has been necessary to cut off the longitudinal pieces, but now the strips are scored deeply enough to enable them to be broken off. The fuse described above is shown in Fig. 1. The fuse shown in Fig. 2 has been improved by slightly dishing the metal bar threaded on the cutter, thereby preventing the fuse wire from being cut. The wire can be

crushed to the thickness of paper at the edge, it is declared, while the cross-section of metal at the center remains the same.

Attachment Plugs

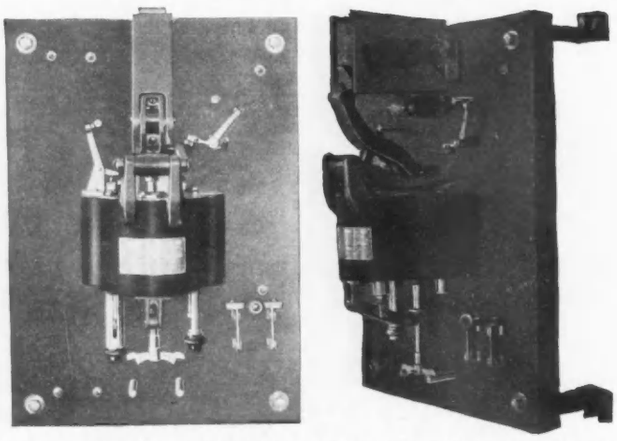
Attachment plugs of the type shown in Fig. 1 are being made by the Arrow Electric Company, Hartford, Conn., with brass caps in the fuse and fuseless types. The cap is provided with two bushings, one of which fits into the other. The inner diameter of the smaller

FIGS. 1 AND 2—ATTACHMENT PLUG, WITH BRASS CAP, AND WATERPROOF ATTACHMENT PLUG

bushing is 9/32 in., admitting No. 16 lamp cord. The inner bushing can be removed when larger cord is utilized. The inside diameter of the larger bushing is 13/32 in. and is for use with No. 16 portable cord. In Fig. 2 is shown a weatherproof attachment plug of the fuseless type, which is fitted with 6 in. leads of No. 14 B. & S. stranded rubber-covered wire.

Automatic Reclosing Circuit-Breakers

The reclosing circuit-breaker for direct-current circuits shown in Fig. 1 is of an improved type and is similar in design to the circuit-breaker described in the ELECTRICAL WORLD of July 18, 1914, page 145. It differs from the latter in that an adjustment has been provided which permits the circuit to be set so that it will open at any desired current value and reclose with any desired load. This adjustment renders the breaker capable of distinguishing between a short-circuit condition and that obtained with lamps or self-starting motors on the line. The device shown in Fig. 2 is of the



FIGS. 1 AND 2—AUTOMATIC RECLOSING CIRCUIT-BREAKERS

magnetic-blowout type and is designed particularly for branch-circuit work. It is shown in the open position in the illustration and is rated at from 100 amp to 300 amp. The circuit-breaker shown in Fig. 1 is shown in the closed position and is made with ratings of 300 amp and above. The circuit-breakers are being made by the Automatic Reclosing Circuit Breaker Company, 31 West Mound Street, Columbus, Ohio.

Return-Call Buzzer and Push-Button

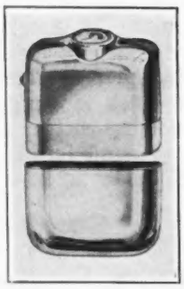
A return-call signal device designed for use in hospitals, college dormitories, Y. M. C. A. buildings, etc., has recently been developed by the Holtzer-Cabot Electric Company, Brookline, Mass. The buzzer is oper-

RETURN-CALL BUZZER

ated by a push-button or from buttons on a return-call annunciator at a central station, which may be in the office of the building. The mechanism is substantial, being made up of heavy brass punchings. Use is made of German-silver springs and silver contact points. The frame of the buzzer is of cast iron and is finished in black enamel. The binding posts and other exterior fittings are of polished nickel. The distance between centers of the mounting holes is 3.5 in., and the buzzer measures 3.25 in. wide and 4 in. high.

Telescopic Flashlamp Case

The flashlamp case of vest-pocket size shown herewith avoids the use of hinges. The case consists of two parts, each drawn from a solid sheet of metal. One part telescopes into the other, and when pushed to-



TWO-PART FLASHLAMP CASE

gether the two lock. With a slight pressure on the side of the case the two pieces can be pulled apart. The case can be finished in nickel, gun-metal, statuary bronze, silver and gold. It is being placed on the market by the Usona Manufacturing Company, 1 Hudson Street, New York.

Storage-Battery Voltage Regulation

BY C. S. REDDING

It is often a matter of considerable importance, especially in photometric work, to secure a source of unidirectional emf which will remain constant. Storage batteries are generally used for this work, but the voltage of a storage battery is only approximately constant, there being a decrease of 10 per cent or more between the time of charge and discharge. Moreover, if two or

more circuits are being operated from the same battery a change of load at any point will change the potential difference at any other point because of a corresponding change in the terminal voltage of the battery.

Apparatus was recently designed and constructed for controlling the voltage of a storage-battery circuit, and has been in satisfactory operation for a sufficient length of time to prove its success. The battery which it was desired to control is used on the standard lamp circuits of several photometers. The battery has a maximum voltage of 119 volts, and it was required to maintain a terminal emf of 115 volts to an accuracy of 0.05 volt. The current from the battery varies from 5 amp to 12 amp.

The equipment provided for the purpose is shown in Fig. 1, and consists of a sensitive detector or regulating element which actuates a double relay which in turn controls a reversing motor, operating a series rheostat in the main battery circuit. The principle of the operation of the equipment may be determined from the diagram shown in Fig. 2. Directly across the battery and control rheostat is connected the regulating element, in which are two resistors *AB* and *BC*, the resistances of

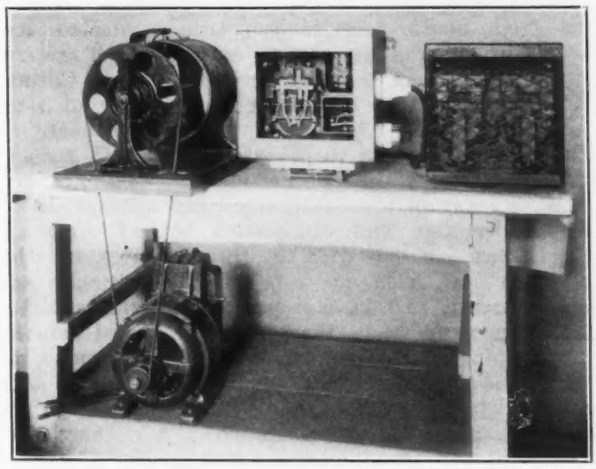


FIG. 1—APPARATUS FOR CONTROLLING VOLTAGE OF BATTERY

which are of such values that when there is an emf of 115 volts between *E* and *F* the current in the resistors is such that there is an emf between *A* and *B* exactly equal to that of a Weston standard cell contained in the instrument. The cell is so connected that its emf opposes that across *AB*, and therefore when the battery emf between *E* and *F* is 115 volts there will be no energy passing through the galvanometer *G*, the galvanometer also being part of the regulating element. When, however, the emf across *EF* changes, the drop across *AB* also changes, with a resulting flow of energy through the galvanometer, causing it to deflect. This actuates the restoring mechanism, as will be later explained, causing a circuit to be closed through the relay, operating the motor and changing the position of the contact on the control rheostat, which adds or subtracts resistance from the circuit, depending upon whether the emf has increased or decreased.

The relay-actuating portion of the restoring element is a mechanism which has been used for other purposes and which has proved its worth under the most difficult circumstances. Briefly, its operation is as follows: Once every two seconds the shaft 6 (Fig. 3) makes a complete revolution. It is operated by a small constant-speed motor. Once in each revolution the cam 6*C* lifts the lever 3 pivoted at 24*B* and 24*B*. Attached to 3 is an arm 2 pivoted on 3, which, when lifted, opens a contact normally existing between 2 and the disk 1. If the galvanometer is balanced, the pointer is raised between the two bell-crank levers 4*L* and 4*R*. If, however, the galvanometer is unbalanced, the pointer is forced by 3 against the horizontal element of either 4*L* or 4*R*, thus displacing 2 from its horizontal position through one of the pins 2*C*. The cam 6*C* now allows 3 to return

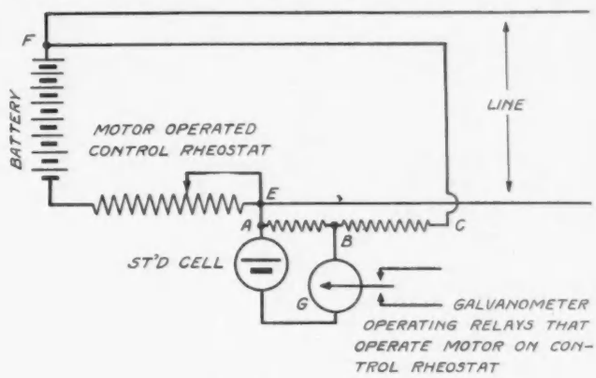
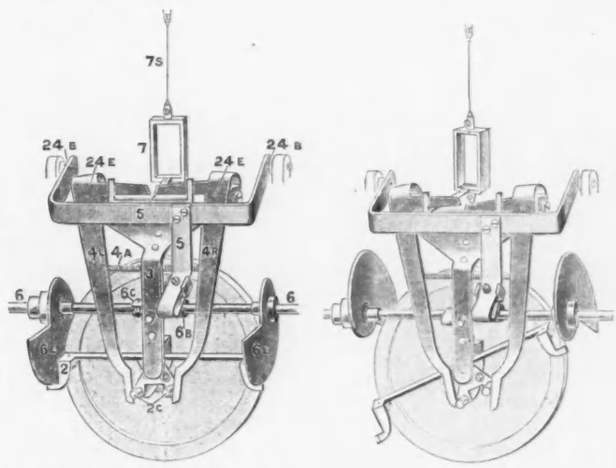


FIG. 2—DIAGRAM OF CONNECTIONS

to its normal position, 2 again makes contact with 1, and the mechanism is as shown in Fig. 4. The cams 6*E*, which are insulated from the shaft and connected one to each relay circuit, now force 2 back into a horizontal position, and while they are in contact with 2 complete through 1 a circuit through one side or the other of the relay. It can be seen that the length of time the relay is closed will depend upon the amount that 2 is displaced, and this will depend, as will be seen from Figs. 3 or 4, upon the amount of deflection of the galvanometer.

The apparatus is not instantaneous in its adjustment, but under the rather difficult conditions stated in the early part of this article effects a balance under the worst condition in twelve seconds. When the load is not changed the instrument takes care of the natural depreciation of the battery voltage so well that there is never a departure of as much as 0.05 volt from normal. The regulation is accomplished in every case without any hunting.



FIGS. 3 AND 4—MECHANISM BALANCED AND UNBALANCED

Such an equipment as here described can be applied to many regulation problems. This apparatus operates on a potentiometer circuit, but it can be made to operate upon a Wheatstone-bridge circuit if desirable. The equipment was manufactured by the Leeds & Northrup Company, of Philadelphia, for the Westinghouse Lamp Company of Bloomfield, N. J.

CURRENT NEWS SECTION

MR. TOWNLEY ON SOUTH AMERICA

His Trip Shows that Careful and Intelligent Cultivation Is Necessary for Extension of Our Commerce

Mr. Calvert Townley, assistant to the president of the Westinghouse Electric & Manufacturing Company, returned to New York on April 19 after a tour through South America on behalf of his company's affairs in that part of the world. He sailed from New York on Oct. 14, going to Liverpool and, after a few days in London, re-embarked for Rio de Janeiro, Brazil. His travels in South America took him successively through Brazil, Uruguay, Argentina, Chile, Bolivia, Peru, the Isthmus of Panama, Colombia and Venezuela, and included therefore every country on that continent except Paraguay, Ecuador and the Guianas. He returned to the United States via the islands of Curaçao and Porto Rico. The entire trip lasted for six months and five days.

Several of the ships on which Mr. Townley traveled were under the British flag, and he enjoyed the excitement of dodging the German cruisers. He was in Rio de Janeiro at the time of the new presidential inauguration and witnessed the university student riots in which a number of men were shot and to quell which the troops had to be called out. He missed the naval battle off the Falkland Islands by a narrow margin of time, saw the festival of flowers at Buenos Aires, and crossed the continent over the trans-Andine Railroad into Chile, passing over the Andes between snowdrifts towering above the cars on the second train which made the westward journey after the road had been closed for several months. He saw a boycott against a raise of fare by the German-owned electric railway company at Valparaiso, witnessed a political demonstration at Iquique, and was in Lima, Peru, for the carnival. He reached the Isthmus of Panama just in time to see the effects of the big slide in Culebra cut, which closed the canal to navigation for several days, as well as to observe the methods employed to get rid of the earth and start vessels through again.

At the request of the Electrical World, Mr. Townley discussed his journey as follows:

"My trip was made on behalf of the Westinghouse Electric & Manufacturing Company, which has been engaged in business throughout South America for many years and is by no means a stranger in that field. In talking of the conditions existing on that continent it is easy to fall into the error of considering South America as a unit and attempting to make a general statement which will apply to all parts of it, whereas South America is composed of many very distinct units where widely varying conditions prevail. The various South American countries are as different from one another as are Canada, the United States and Mexico. Indeed, they differ vastly more than do Canada and the United States. There are, however, some statements which can be applied generally to all South American nations. For example, they have established lines of activity—methods of doing business through channels which are satisfactory to them and which they are not anxious to change. Of course, at the present time normal conditions of South American trade with various European countries are interrupted seriously, and there is a better opportunity for our people to establish relations with them than would exist in normal times. However, it would be a serious mistake to think of South American markets, as many people seem to do, as trees laden with ripe fruit waiting to be picked; rather, are they more like fertile fields ready for the planting but from which crops can be reaped only after a lapse of time and by careful and intelligent cultivation.

Purchasing Power Below Normal

"Also at the present time the purchasing power of all the South American countries is considerably below normal owing to the fact that their revenues come largely from exports and the markets for these have been curtailed tremendously. The carrying trade to and from South America has been conducted very largely by ships of the various nations which are now at war. Of these a large percentage were German and have ceased to operate entirely, many of them being tied up in harbors, while the British boats, although they continue to operate, do so with reduced service and uncertain schedules.

"With many of the South American nations heretofore importation and exportation with Europe has largely exceeded that with the United States, but this seems to have been due to perfectly legitimate and logical causes; that is, Europeans have cultivated the South American trade, they have established banking and shipping facilities, have invested their money in South American enterprises and have organized with varying degrees of thoroughness commercial campaigns to get South American business. While there may exist here and there more or less sentiment for or against one nation or another, I do not believe that such sentiment will play any material part in affecting the development of trade relations between these various countries and the United States. If our people will devote to the development of South American trade the same study and enterprise which they have devoted in the past to business at home, they will get satisfactory results, but they must expect to furnish what the South Americans want and to do business in the South American way.

"Those who believe that any of the European nations now at war will be permanently out of business in South America after peace is concluded are liable to be very sadly mistaken. I think that in the future we must expect to have to meet just as keen competition as we have in the past and that the interference with trade between South America and Europe caused by the war is only temporary and therefore while it lasts gives us an opportunity to get started and make much more rapid progress than would be possible under normal conditions.

"In general, electrical development as well as all other modern development is more backward in South American countries than it is at home. Possibly the average man visiting South America for the first time would conclude that there is less development there than he would have expected to find, but conditions in general are not so favorable for rapid development and perhaps they never will be so. In a number of the South American countries, particularly those on the

west coast, there is little or no immigration because wages are low and immigrants are not attracted; consequently, as there is very little difference between the birth rate and the death rate, the population increases very slowly, if at all, and one of the most important elements heretofore responsible for our own country's growth and progress does not exist there. The lack of a competent and sufficient labor market is one great handicap upon the development of many South American nations.

Financial Conditions Improved

"Before my departure from the United States I heard much of serious money stringency all over the South American continent. This condition, however, was probably most acute just after the outbreak of the war. Although in many places the commercial situation was very bad indeed and rates of exchange were high and variable, I found American travelers everywhere who were having no difficulty at the banks with their drafts and letters of credit.

"Although the people in several of the nations are economizing, are short of money and are buying less of every commodity, the banks are meeting their obligations and the various governmental authorities are attempting, each in its own way, to deal with the abnormal situation.

"The principal industries of Brazil, for example, are the exploitation of coffee and rubber, and that nation is contending with a demoralized rubber market and a restricted coffee demand. Argentina is recovering from a collapsed land boom, but its principal exports are animal products and grain, for which there is an excellent market at high prices in Europe. Chile depends largely on the sale of nitrate for its revenue, and the market for that article is greatly restricted. Peru is still suffering from the combined effects of having defaulted on its foreign bonds some time in the past and a very recent revolution which repudiated its local currency.

"In most of the South American countries there is surprisingly little information about electrical progress in the United States, but everywhere much interest is manifested, and the copies of the last issues of several of our electrical publications which I carried with me and distributed were sought eagerly. In fact, every sort of American publication was welcomed and read with avidity.

The Small Manufacturer

"You ask me what are the prospects for the development of the South American business for the American merchant or manufacturer having only a moderate capital, and that is a difficult question to answer. The cost of direct representation in the South American countries is, of course, much greater than the corresponding expense at home and in any individual case might easily exceed the profit to be derived from the business developed over a period of years. Furthermore, it is difficult to get satisfactory representation for American products in many places, and the character of such representation and of the men who conduct business there is relatively of much greater importance in South America as compared with the products offered than it is at home. Combination of American concerns in the same or in different lines of business has been mentioned frequently as a means of dividing the expense of representation and making it possible for those with moderate capital to enter the South American fields, but if that plan is to be feasible our federal authorities must first make it very clear that it is legal and is not, as many hold, in violation of the terms of the Sherman anti-trust law."

N. E. L. A. Accounting Committee Meets

The accounting committee of the National Electric Light Association met in New York on April 22 to discuss plans for the accounting sessions at the San Francisco convention.

The committee went over the proposed by-laws for the new Accounting Section and plans for the future. The by-laws are before the executive committee of the main association, but it is expected that they will receive the necessary formal approval before the convention. The method of organizing the section and the selection of a nominating committee were discussed, and it was decided that these questions should be left open for the members of the accounting committee at the convention.

A number of protests have been received in regard to the provision in the uniform system of accounts that sinking-fund payments should be charged to income. The committee considered these and directed the committee on uniform accounts to prepare a resolution for submission at the San Francisco convention which might also be presented to the executive committee of the main association, as that committee has approved the classification as it stands.

"Electrical Prosperity Week" Meetings

"Electrical Prosperity Week" was discussed at four meetings in Ohio last week. Organizations in Cleveland, Cincinnati and Toledo were addressed by members of the staff of the Society for Electrical Development of New York, who told of some of the plans for the campaign.

Two meetings were held in Cleveland, the first on the evening of April 21, under the auspices of the Electrical League of Cleveland, at the Hollenden Hotel. Over 275 electrical men from northern Ohio cities were present, including representatives of manufacturing plants. Messrs. J. M. Wakeman, general manager, H. W. Alexander, director of publicity, and A. J. Edgell, of the display service bureau of the society, were the speakers. Mr. S. E. Doane, chief engineer of the National Lamp Works, was chairman. The work of the society was described, lantern slides were exhibited, and a motion-picture play was presented.

General Manager Wakeman paid a tribute to the enterprise of Mr. J. Robert Crouse, of Cleveland, the originator of the society. The league promised hearty support in promoting the "Electrical Prosperity Week" campaign.

At a Jovian luncheon on April 22 Mr. H. W. Alexander talked on "Sales Making" and the tentative plans for "Electrical Prosperity Week." Mr. Paul B. Zimmerman was chairman. Mr. G. B. Muldaur, manager of the field co-operative bureau of the society, spoke of the work of the section in harmonizing relations between electrical interests. Mr. Wakeman showed how the Jovians with their slogan, "Altogether All the Time for Everything Electrical," are linked with the society slogan, "Do It Electrically." He praised the work of the order and acknowledged the offer of support received from Jupiter Homer E. Niesz.

Under the auspices of the Rotary Club, Toledo, Ohio, on April 23, representative business-men at the Hotel Secor heard Messrs. Wakeman, Alexander and Edgell discuss "Electrical Prosperity Week."

Messrs. Alexander and Edgell made brief "sales" talks to the new-business staff of the Toledo Railways & Light Company on the same day.

Mr. Edgell spoke before the Cincinnati Association of Display Men at the Chamber of Commerce on April 22. Mr. Edgell, who is president of the Greater New

York Association of Display Men, discussed better illumination.

At the invitation of the Kilowatt Club of Brooklyn Messrs. Alexander and Edgell spoke at the meeting on the evening of April 26 on "Electrical Prosperity Week" and "Sales Making." Mr. Louis Kalischer, president of the Kilowatt Club, presided. Mr. Alexander described the tentative plans, and also discussed sales methods. Mr. Edgell discussed the advantages of utilizing show windows for displaying electrical goods. The meeting was attended by about 100 Brooklyn contractors.

Jovians for "Electrical Prosperity Week"

At the recent meeting of the Jovian Congress and Past-Jupiters' Association in Chicago the following resolution was passed:

"Resolved, That in the event of an invitation being extended to the Jovian Order to participate in promoting a so-called 'National Electrical Week,' the Jovian Order accept the invitation and request its various local organizations to co-operate in the movement."

General Manager Wakeman of the Society for Electrical Development sent the invitation directly to Jupiter Homer E. Niesz, who replied in part as follows:

"I am very pleased to advise you that it is the purpose of the order to participate in the promotion of 'Electrical Prosperity Week,' and we will request the various electrical organizations of the Jovian Order to co-operate in the movement. Mention of this affair will be made in the forthcoming issue of *The Jovian*, and any assistance that can be rendered by the present administration will be very gladly given with the view to making this an extremely successful affair."

Plans are being formulated by a Jovian committee at Toledo, consisting of Tribune Guy H. Oliver and Mr. Walter S. Bissell, who are working with Mr. E. R. Kelsey, secretary of the Rotary Club, and a committee from the Commerce Club for a joint meeting at Toledo on May 6.

Preliminary Program of N. E. L. A. Convention

Although still subject to addition and revision, the accompanying program of the convention of the National Electric Light Association to be held in San Francisco, June 8 to 11, will probably be followed in the main. There will be three parallel sessions during the afternoon of Tuesday, June 8; three Wednesday morning, two Wednesday afternoon, three Thursday morning, and two Friday morning.

As will be noted from the program, a large amount of business is presented for consideration, and most of it is of an important character. At first it was proposed to crowd the work into three days. Various reasons, however, forbade limiting the sessions to Tuesday, Wednesday and Thursday, but extra sessions were added to allow the subject matter to be treated in a more leisurely way, favorable to fuller discussion. Moreover, as the special trains do not depart on their return trips until Saturday and Sunday, good use is made of some of the intervening time.

Another feature of interest is the proposed shifting of the public-policy meeting from Wednesday to Thursday evening, owing to difficulty in securing a suitable hall for Wednesday night. Usually, at the N. E. L. A. conventions for many years past there have been no sessions on Wednesday afternoon because of the objection to holding the delegates together for sessions morning, afternoon and evening, which would make a strenuous and exhausting day. With the public-policy meeting on Thursday evening, the afternoon recess will also fall on that day, and as there will be no baseball match this year, the afternoon will be devoted, by invitation of the exhibition committee, to an official visit of the delegates to the electrical exhibits at the Exposition.

General Executive and Public Policy Sessions

Tuesday, June 8, 10 *a.m.*

(1) Welcome to the city, by Mayor Rolph. (2) Welcome to the Coast, by Mr. John A. Britton. (3) Address of President Scott. (4) Announcements. (5) Report of committee on organization of the industry, by Mr. George Williams. (6) Report of the secretary, by Mr. T. C. Martin. (7) Report of insurance expert, by Mr. W. H. Blood, Jr. (8) Report of committee on progress, by Mr. T. C. Martin. (9) Report on "Question Box," by Mr. S. A. Sewall. (10) Report of committee on education, by Mr. J. F. Gilchrist. (11) Paper, "Revivals," by Mr. Paul Lüpke.

Wednesday, June 9, 12:30 *p.m.*

Brief executive session.

Thursday, June 10, 8:45 *p.m.*

(1) Reading report of the public-policy committee, by Mr. W. W. Freeman. (2) Address, "Public Service Commission Relationships," by Mr. John H. Roemer, ex-member Wisconsin Railroad Commission.

Second General and Executive Sessions

Friday, June 11, 10 *a.m.*

(1) Report of committee on company sections, by Mr. F. J. Arnold. (2) Paper, "Company Section Work," by Mr. D. C. Bruce. (3) Paper, "The Electric Vehicle and the Central Station," by Messrs. J. F. Gilchrist and A. J. Marshall. (4) Address, "Electrical Prosperity Week," by Mr. J. M. Wakeman. (5) Report of committee on Doherty and Billings prizes for company section papers, by Mr. Paul Lüpke. (6) Report of committee on memorials, by Mr. T. C. Martin. (7) Report of committee on president's address. (8) Report of committee on resolutions. (9) Report of nominating committee. (10) Election of officers.

Technical and Hydroelectric Sessions

Tuesday, June 8, 2:30 *p.m.*

(1) Report of committee on meters, by Mr. C. G. Durfee. (2) Report of committee on electrical apparatus, by Mr. L. L. Elden. (3) Report of committee on grounding secondaries, by Mr. Paul Spencer. (4) Paper, "Application of the Diversity-Factor," by Mr. H. B. Gear. (5) Address, "Features of the Lighting of the Panama-Pacific Exposition," by Mr. W. D'A. Ryan.

Wednesday, June 9, 10 *a.m.*

(1) Address of chairman of hydroelectric committee, by Mr. M. R. Bump. (2) Report of committee on hydroelectric and transmission progress, by Mr. T. C. Martin. (3) Report of committee on prime movers, by Mr. I. E. Moultrop. (4) Paper, "Practice in High-Head Hydraulic Plants," by Mr. J. P. Jollyman. (5) Paper, "Governor Effort Analysis," by Mr. E. D. Searing. (6) Paper, "Oil Burning," by Mr. J. P. Jollyman. (7) Paper, "Analysis of Governor Effort," by Mr. E. D. Searing. (8) Paper, "Oil Burning," by Mr. P. M. Downing.

Wednesday, June 9, 2:30 *p.m.*

(1) Report of committee on overhead-line construction, by Mr. Thomas Sproule. (2) Paper, "Overhead-Line Construction on the Coast," by Mr. J. C. Martin. (3) Report of hydroelectric sub-committee on high-tension transmission and construction, by Mr. R. J. McClelland. (4) Report of hydroelectric sub-committee on high-tension apparatus, by Mr. W. N. Ryerson. (5) Report of hydroelectric sub-committee on main-line electrification of railroads, by Mr. B. F. Wood.

Thursday, June 10, 10 *a.m.*

(1) Report of committee on terminology, by Dr. A.

S. McAllister. (2) Report of committee on street lighting, by Mr. J. W. Lieb. (3) Report of committee on underground construction, by Mr. P. Torchio. (4) Timber preservation, by Mr. R. A. Griffin. (5) Report of committee on accident prevention, by Mr. M. J. Insull. (6) Paper, "Opportunities of the Public Service Companies in General Accident Prevention," by Mr. C. B. Scott.

Friday, June 11, 10 *a.m.*

(1) Report of committee on power sales methods; demonstration of a power sale by Mr. C. H. Stevens. (2) Completion of unfinished business. (3) Report of section nominating committee. (4) Election of section officers.

Accounting Sessions

Tuesday, June 8, 2:30 *p.m.*

(1) Chairman's address, by Mr. H. M. Edwards. (2) Report of the library committee, by Mr. E. J. Allegaert. (3) Report of the "Question Box" committee, by Mr. E. C. Scobell. (4) Report of the committee on N. E. L. A. uniform system of accounts, by Mr. J. L. Bailey. (5) Paper, "Some Opportunities of Public Utility Accountants," by Mr. L. H. Reynolds (auditor California Railroad Commission).

Wednesday, June 9, 10 *a.m.*

(1) Paper, "Workmen's Compensation Insurance," by Mr. R. J. Sullivan, secretary Travelers' Insurance Company. (2) Paper, "Electric-Vehicle Cost Accounting," by Mr. W. P. Kennedy. (3) Paper, "Standardizing the Accounts of the Pacific Gas & Electric Company," by Mr. M. H. Bridges. (4) Paper, "Record of Property or Construction Expenditures," by Mr. P. R. Ferguson.

Thursday, June 10, 10 *a.m.*

(1) Report of committee on cost accounting, by Mr. J. H. Gulick. (2) Paper, "Analysis of Costs by an Electricity Supply Company for Rate-Making Purposes," by Messrs. A. D. Spencer and R. W. Symes. (3) Paper, "Analytical Accounting for Central-Station Purposes," by Mr. O. B. Coldwell. (4) Presentation and adoption of new accounting section by-laws. (5) Report of the nominating committee. (6) Installation of section officers.

Commercial Sessions

Tuesday, June 8, 2:30 *p.m.*

(1) Chairman's address and (2) report of committee on foreign relations, by Mr. Douglass Burnett. (3) Report of Commercial Section finance committee, by Mr. J. F. Becker. (4) Report of membership committee, by Mr. J. G. Learned. (5) Report of publications committee, by Mr. E. A. Edkins, and (5a) report of sub-committee on "Salesman's Handbook," by Mr. C. J. Russell. (6) Report of committee on education of salesmen, by Mr. F. R. Jenkins. (7) Report of committee on commercial department terminology, by Mr. M. E. Turner.

Wednesday, June 9, 10 *a.m.*

(1) Address, by Mr. C. C. Moore, president Panama-Pacific Exposition. (2) Report of power sales committee on typical power sales development in the West, by Mr. J. H. McDougal. (3) Report of committee on merchandising and recent development of electric appliances, by Mr. R. R. Young.

Wednesday, June 9, 2:30 *p.m.*

(1) Report of lamp committee, by Mr. F. W. Smith. (2) Report of committee on wiring of existing buildings, by Mr. R. S. Hale.

Thursday, June 10, 10 *a.m.*

(1) Report of rate research committee, by Mr. R. S. Hale. (2) Report of power sales bureau of the Commercial Section, by Mr. C. J. Russell. (3) Paper, "The Commercial Application of Resistance Furnaces," by Mr. C. W. Bartlett. (4) Paper, "A Stassano Furnace Installation at Redondo, Cal.," by Mr. W. M. McKnight. (5) Paper, "Electric Furnace Power Loads," by Mr. F. T. Snyder. (6) Paper, "Charges for Electric Welding Service," by Mr. C. K. Nichols.

A. I. E. E. Tests for Porcelain Insulators

During the last three years the subject of the inspection and test of high-tension porcelain line insulators has been under discussion by the American Institute of Electrical Engineers. The need of more uniformity in the commercial testing practice on such insulators has long been manifest, and the very erratic behavior of insulators on several of our important lines has indicated a need for more searching tests. As a result of the consideration of these questions by various Institute committees specifications have been drawn up by the transmission committee to serve as a model. With the authorization of the board of directors this specification has been approved and recommended by the transmission committee, and copies are now available on application to the secretary of the Institute.

A paper entitled "Provisional Specification Covering Inspection and Test of High-Tension Line Insulators of Porcelain for Over 25,000 Volts" is printed in the May *Proceedings* of the society. This specification does not include specific instructions covering the very important subject of impact or high-frequency testing, as this subject is not yet considered sufficiently well standardized. It is expected, however, that the specification will be added to and amended from time to time in order that it may conform with the best practice.

New Battleship to Be Propelled Electrically

Although it has been a long and difficult task to secure proper recognition for the advantages of electric ship propulsion, the outlook at present is promising, said Mr. W. L. R. Emmett, of Schenectady, before the Western Society of Engineers at Chicago, Ill., on April 26. Contracts for equipping the United States battleship *California* with the General Electric Company's turbo-electric drive were closed on April 24. The *California*, a 30,000-ton vessel which the government is now ready to construct, will be equipped with two 18,000-hp, 2200-r.p.m. turbo-generators and four induction-type driving motors. All of the engine-room auxiliaries will be motor-driven, direct current for operating these machines being taken from the same small non-condensing steam turbo-generators which will supply excitation for the main alternators.

The maximum speed of the ship will be 22 knots per hour and the cruising speed 18 knots per hour. At 14 knots per hour the turbines will develop 7000 hp and at 22 knots they will produce 36,000 hp, but on account of the high efficiency of the electrical speed-adjustment system used the water rate of these machines is approximately the same at both speeds. Seventy-five per cent of the power generated theoretically by the ship's turbines will be delivered to the generator, and there will be an 8 per cent loss in the electrical equipment. On the *Lusitania*, one of the most modern large passenger ships afloat, the turbines operate at 220 r.p.m. and deliver to the propellers 62 per cent of the power developed. Estimates of the Brooklyn Navy Yard showed that the use of electric drive saved more than $160,000 in the construction of the *California*. The *Lusitania* could be re-equipped for electric drive, said Mr. Em-

mett, and a saving of $150,000 a year effected in its coal bill.

The machinery of the United States collier *Jupiter*, Mr. Emmett said, had been a complete success. The main turbines of this vessel are operating on 11 lb. of steam per hp-hr., and the ship's power plant as a whole is 20 per cent more efficient than that of any other ship afloat. It is 30 per cent more efficient than the plant of any reciprocating steam-engine-driven vessel. Ever since it was launched the *Jupiter* has operated with very low specific steam consumption, and recent examinations have shown that its power plant is still as good as new. The successful operation of this collier was one of the factors which induced the government to install electric drive in the *California*.

Regarding future electric ship propulsion Mr. Emmett is optimistic. Except for the torpedo-boat destroyers, the field of electric drive in the navy is almost universal. In such light craft the necessity of reducing weights decides in favor of geared-turbine drive. Sometimes slow-speed, low-powered vessels of certain classes also can be driven more economically through gears, but the great majority of seagoing ships could now rehabilitate their plants, install electrical machinery, and save enough coal in a year or two to wipe out the extra investment. The General Electric Company, said Mr. Emmett in closing, has been figuring recently on equipment for two Russian battleships of 70,000-hp to 90,000-hp rating and on several large vessels for the United States Navy.

In the discussion of Mr. Emmett's address it was brought out that control systems will probably be installed on the *California* so that the movements of the ship can be guided directly from the bridge and from several other stations without the intervention of a signal system.

In announcing the award of a contract to the General Electric Company for electrical propelling equipment for the *California* at $431,000, Secretary of the Navy Daniels stated that the New York Navy Yard submitted an estimate of $631,000 for the installation of steam propelling equipment. Thus electric drive is not only less expensive to install but it also offers superior economy in operation, a reduction in weight and utilization of full power in backing. The latter is an important military feature which is not obtainable in an all-turbine installation on account of the limitations of space and weight imposed on the design of the ship. There is a further advantage in that it will be unnecessary to provide a backing turbine, as reversal of the shafts will be accomplished through motors instead of by turbines. The design adopted contemplates the greatest simplicity of operation, Mr. Daniels said.

Developments in Cleveland Municipal Situation

The Board of Control of Cleveland has been asked to approve a minimum rate of 0.5 cent per kw-hr. for energy for motor service from the municipal plant. Heretofore the minimum has been 1 cent per kw-hr. It is reported that the minimum rate made by the Cleveland Electric Illuminating Company is 0.75 cent, paid by the Cleveland Railway Company on a ten-year contract. The earnings of the municipal plant with the reduced rate, it is stated, will be $500 per month less than in the past, but it is argued in support of the reduction that this will be offset soon by the addition of new business.

On April 24 Director of Public Service Sidlo received a communication from Mr. S. C. D. Johns, secretary of the Cleveland Electric Illuminating Company, declining to comply with the request of the city for figures showing the amount collected from patrons in excess of 3 cents per kw-hr. since the enactment of the ordinance making this rate. This ordinance was passed on May 1, 1913, and when the company appealed to the Public Utilities Commission a bond of $1,000,000 was required to insure the return of the excess to patrons in case the ordinance should be upheld. The city will ask the commission to increase this bond on the ground that the excess now amounts to more than $1,000,000. Mr. Johns said that the assets of the company make the people perfectly safe, but that if the commission decides that additional security is necessary it will be given cheerfully.

It is announced that Mr. A. B. du Pont, adviser and associate of the late Tom L. Johnson in street railway matters at Cleveland and consulting engineer in the construction of the municipal electric plant in that city, has been retained by several central-station companies to engage in research work pertaining to valuation.

Municipal-Ownership Movements

Voters of Memphis, Tenn., have voted to authorize the issue of $1,500,000 bonds for the erection of a municipal electric-light plant or the purchase of an existing plant.

The result of an election in Grand Rapids, Mich., on April 5 was the rejection by voters of a plan for the construction of a municipal gas plant. The franchise of the Grand Rapids Gas Light Company, a subsidiary of the American Light & Traction Company, expires in five years. Following agitation for a reduction in gas rates the company offered a maximum rate of 75 cents per 1000 cu. ft. if its franchise should be extended for twenty years from the date of expiration. The city authorities declined to accede to this rate, and they prepared to submit the question of franchise extension to the people on the primary ballot on March 16. The plan was to vote at the same time upon the question of construction of a city plant. A few days before the election the municipal plant proposal was withdrawn, and voters had before them only the proposition for renewal of the franchise, which they rejected. The construction of a municipal plant was then urged for vote on April 5. The campaign against the proposal was directed by the Bureau of Public Service Economics, of New York, represented by Mr. F. C. Henderschott. An active campaign followed, with mass meetings on behalf of both sides, public dinners, etc. Mr. Henderschott and Mr. F. G. R. Gordon, of Haverhill, Mass., made many addresses. The result was a vote of 4471 for the municipal plant and 11,396 against it. The announced plan of the municipal-ownership advocates was to extend the policy of public ownership to electric railways and electric-lighting plants if they secured public approval for the proposed gas plant.

Indianapolis Street-Lighting Contract Upheld

The Indiana Supreme Court has rendered a decision in the case in which Mr. Herbert H. Rice attempted to prevent the city of Indianapolis from contracting with the Merchants' Heat & Light Company for street lighting. The decision affirmed the finding of the Marion Circuit Court, which held that there was no authority for enjoining the city from fulfilment of its contract. Mr. Rice took the position that the city, in entering into the contract, had usurped the power and authority of the Public Service Commission. The Supreme Court said in part:

"It is asserted by appellant [Rice] that the contract is void in its entirety, and that the other provisions

therein contained cannot be enforced. As a taxpayer appellant has no interest in the contract, except in so far as its performance will affect the public treasury of the city, and having failed to show by proper allegations that any of the public funds are in danger of being illegally dissipated, the first paragraph of the complaint fails to state a cause of action.

"The second paragraph of the complaint fails to state facts sufficient to constitute a cause of action in favor of appellant as a private consumer."

The Lighting of Small Interiors

"Knowns and Unknowns in the Lighting of Small Interiors" was the subject of a lecture before the Chicago Section of the Illuminating Engineering Society on April 22, 1915, by Mr. J. R. Cravath. The speaker attempted to summarize briefly the established facts, the matters in question and controversy, and unknown or unexplored matters in connection with the lighting of small rooms. The speaker treated the subject from three standpoints, ocular comfort and health, efficiency of light utilization, and artistic or esthetic effects. He gave a practical demonstration with the aid of lamps and diffusing globes of what different values of brightness mean. The unshaded tungsten-lamp filament, the carbon-lamp filament and the Welsbach gas mantle were said to be too bright for use in locations where they must be faced continuously for some time. When frosted inclosing globes are used the brightness is greatly reduced, but evidence is gradually accumulating, as a result of eye-fatigue test work by Dr. C. E. Ferree and others, that even frosted lamps are too bright to be faced continuously without eye fatigue. The speaker expressed the opinion that from the evidence at hand a brightness of over 1 cp per sq. in. (452 apparent foot-candles), emitted from a globe or bowl of sufficient size to light a small room satisfactorily, would be likely to cause unnecessary eye strain if faced for some time by the average person.

The bowls actually used at the present time for semi-direct lighting vary greatly in brightness, the most common range for heavy pressed bowls being from 2 cp per sq. in. (904 apparent foot-candles) down to about 0.075 cp per sq. in. (34 apparent foot-candles). There is still room for investigation as to the limit of brightness which should be placed for semi-direct lighting bowls for small rooms, but it seemed probable to the speaker that a brightness of about 0.5 cp per sq. in. (226 apparent foot-candles) for such bowls should be about the maximum. However, if the bright area exposed is small, so that the total candle-power is low, the limits just suggested may be comfortably exceeded. The speaker considered it to be established that diffuse or indirect light is best for working on paper and polished surfaces, but for working on cloth direct light is equally good if the source is so placed that shadows are not annoying. Bright lamps or globes within the range from 20 deg. to 25 deg. of the line of vision have a blinding effect, aside from any strain or injury to the eyes. The eyebrow of the average person shades the eye from rays of light coming at an angle less than 25 deg. from the vertical. In semi-direct lighting if more than 15 per cent of the light comes directly from the bowl the amount of shadow is annoyingly great; the less the shadow the better the result.

In discussing esthetic effects, Mr. Cravath spoke of the popular preference for artificial light in which yellow rays are prominent and greens and blues somewhat suppressed. The latest types of tungsten lamps may or may not need color correction for artistic effect according to personal taste. Nevertheless, light in which yellow is prominent, as that from the electric incandescent lamps heretofore used, produces some very agreeable effects on complexions and some kinds of room furnishings. The color can easily be controlled either by the use of proper glassware or by painting the ceiling in the proper color where indirect-lighting fixtures are used.

Light coming strongly from one direction produces sharp shadows which bring out wrinkles, and also makes the complexion appear hard. Hence in residences and places where pleasing effects are desired the shadows must be softened by the use of diffused light.

In the discussions Mr. John A. Hoevler stated that some experimental work with the Ferree test for eye fatigue recently conducted at Ohio State University checked very closely with the results obtained by Dr. Ferree at Bryn Mawr. Messrs. M. G. Lloyd, Albert Scheible, R. F. Schuchardt, C. A. Luther, Dr. Harry Gradle, E. O. Dicker and H. D. Butler also discussed the paper.

Civic Forum Medal for Edison

The gold medal of the Civic Forum is to be awarded to Mr. Thomas A. Edison at Carnegie Hall, New York, at 8:15 p. m. on May 6. The speakers of the evening will be Dr. Nicholas Murray Butler, Dr. William Marconi, Dr. C. P. Steinmetz, Dr. R. C. Maclaurin, president of the Massachusetts Institute of Technology, and Mr. Charles A. Coffin, chairman of the board of the General Electric Company. A poem for the occasion will be read by Mr. Percy Mackaye. This is the second award of the medal, it having been given for the first time to Colonel Goethals last year.

Presentation of Edison Medal to Dr. Bell

The sixth Edison Medal, which on Dec. 29, 1914, was awarded to Dr. Alexander Graham Bell, "for meritorious achievement in the invention of the telephone," will be presented to him at the annual meeting of the American Institute of Electrical Engineers in the Engineering Societies Building, New York, on Tuesday evening, May 18, 1915. Mr. Thomas A. Watson, of Boston, Mass., who was associated with Dr. Bell in the early days of the telephone, will give a historical review of the evolution and development of the art of telephony.

The Edison Medal, which was established upon the initiative of a group of friends and associates of Mr. Thomas A. Edison for the purpose of recounting and celebrating the achievements of a quarter of a century in the art of electric lighting, with which the name of Edison is identified, is awarded each year by a committee consisting of twenty-four members of the Institute to a resident of the United States of America and its dependencies or of the Dominion of Canada, "for meritorious achievement in electrical science or electrical engineering or the electrical arts."

Electrical Contractors and Labor Officials Indicted

Forty-one electrical contractors and eighteen labor-union officials in Chicago have been indicted by the United States grand jury. The indictments were returned in Judge Landis' court April 27. The defendants are charged with maintaining a combination in restraint of trade. Many electrical manufacturers outside Chicago, it is alleged, have been prevented by the combine from entering the switchboard and fixture markets in the city.

Miscellaneous News Notes

Ice Utilities in Wisconsin.—A bill is to be introduced in the Legislature of Wisconsin extending the jurisdiction of the Railroad Commission to ice companies. Such properties are to be classified, according to the bill, with other utilities which are under the supervision of the commission. The movement arises from the large increase in the price of ice in recent years.

Water-Power Conservation in Vermont. — The Vermont Legislature has passed a law establishing a water conservation commission authorized to investigate the storage possibilities within the State with special reference to hydroelectric development. The board has the right to expend a sum not exceeding $2,500 for expert engineering advice, and is to report its conclusions to the Legislature two years hence.

Granite Workers' Strike Affects Vermont Central Stations.—The strike of Vermont granite workers is proving costly to the central stations of that State. Almost every stone shed and quarry in the Barre belt, it is stated, uses electricity. Since March 1, when the suspension of work began, the demand on the central stations has greatly fallen off. One lighting company, it is reported, has already curtailed its staff and will be forced to make further reductions if the trouble continues.

Sanitary District Trustees Dismiss Consulting Engineer.—Mr. Lyman E. Cooley, consulting engineer for the Sanitary District of Chicago, has been dismissed by the board of trustees, and the position which he held has been abolished, following Mr. Cooley's action in publishing for professional circulation a report on the district's hydroelectric plant at Lockport, Ill., prepared by himself and other engineers. The fact that the Western Society of Engineers passed a resolution censuring the trustees for not publishing this report for general circulation is also declared to have had some bearing on the case.

Valuation Made Optional in Ohio.—On April 22 the Ohio Senate passed the Reighard bill, which provides that the valuation of public utilities properties shall be optional with the Public Utilities Commission instead of mandatory as at present. The bill had already been passed by the House of Representatives. The law will not affect the valuation of the Cleveland Electric Illuminating Company, the Union Gas & Electric Company of Cincinnati, or any other properties where the work has been begun, but in other cases the commission may use its judgment as to making valuations, whether requested by municipal councils or not.

Properties Little Affected by Texas Storms.—Reports from Texas say that heavy rains beginning on April 23 had very little effect on electrical properties or service. The service of natural-gas properties at some points was entirely interrupted by breaks which resulted from floods. Mrs. A. S. Grenier, vice-president of the Texas Power & Light Company, who is in Dallas, telegraphed to the New York headquarters of the company that no loss or damage to the physical properties of that company had been reported. The service at Taylor, where there is a small plant, was interrupted from midnight until noon on April 23 as a result of the flood, which reached the power plant. Although the rainfall in that section reached 9 in., the machinery was not damaged.

Honors for Illuminating Engineer of San Francisco Exposition.—The night of April 13 was set apart as "Ryan Night" by officials of the Panama-Pacific International Exposition, San Francisco, as the occasion for recognizing the work of Mr. W. D'A. Ryan, chief of the department of illumination. Mr. Ryan was presented with a bronze plaque by President C. C. Moore of the Exposition company, who spoke of Mr. Ryan's work in high terms and expressed the appreciation of the Exposition company. Mr. Ryan responded briefly, testifying to the aid afforded by Mr. G. L. Bailey, electrical engineer of the Exposition, and Mr. George Dickerson, Mr. Ryan's assistant. Brief congratulatory addresses were also made by Messrs. H. D. H. Connick, director of works, and Mr. John A. Britton, member of the board of directors and vice-president of the Pacific Gas & Electric Company. After the ceremonies, which were held in the Court of the Universe, a spectacular fireworks and lighting display was witnessed by about 50,000 spectators within the grounds.

Associations and Societies

Arkansas Electrical Men at Little Rock.—The Arkansas Association of Public Utility Operators will hold its annual convention at Little Rock, May 11 to 13. The Arkansas Association of Electrical Contractors will meet at Little Rock May 12 and 13.

Louisville Jovians Hear About Mr. Edison.—At a meeting at the Preston Hotel Louisville Jovians heard from Mr. Charles Smith, superintendent of the Western Union Telegraph Company in the Louisville district, on the subject "Early Associations with Mr. Thomas A. Edison." Mr. Smith was an operator with Mr. Edison years ago in the Louisville offices of the Western Union company.

Joint Engineers' Meeting at Boston.—A joint meeting of engineers under the auspices of the Boston Section of the American Institute of Electrical Engineers was held at Boston, Mass., on April 23. Mr. Frank W. Hodgdon, chief engineer of the directors of the port of Boston, addressed the gathering on "The Electrical Equipment Used in the Commonwealth Pier Development for the Port of Boston."

Southwestern Electrical and Gas Association.—The eleventh annual convention of the Southwestern Electrical and Gas Association will be held at the Hotel Galvez, Galveston, Tex., May 19 to 22. Friday, May 21, has been designated as Jovian Day, when the Galveston Jovian League will conduct rejuvenation ceremonies. Mr. H. S. Cooper, Slaughter Building, Dallas, Tex., is secretary of the Southwestern association.

Jovians at Salina, Kan.—A Jovian chapter with a membership of fourteen was established at Salina, Kan., last week. The drill team of the Wichita Jovian Chapter initiated the candidates. Twenty Jovians from the Wichita chapter attended the meeting. Nearly 100 persons in Salina and adjacent territory are eligible to membership in the new Salina chapter. Mr. L. O. Ripley, of Wichita, presided at the meeting as Jupiter.

Iron and Steel Electrical Engineers.—The next annual meeting of the Association of Iron and Steel Electrical Engineers will be held at the Hotel Statler, Detroit, Mich., Sept. 8 to 11. Mr. A. H. Swartz, Churchill Avenue, Cleveland, Ohio, is chairman of the convention committee. The last meeting of the present season, to be held on June 5, will be devoted to a general discussion on various subjects of interest to the members. Mr. W. T. Snyder, McKeesport, Pa., is secretary of the association.

International Railway Fuel Association.—In the program for the seventh annual convention of the International Railway Fuel Association, which is to be held at the Hotel La Salle, Chicago, on May 17 to 20, are listed the following papers which may be of interest to central-station operators: "Preparation and Use of Powdered Coal in Locomotive and Stationary Boilers," "Fuel Conditions in South America," and "Storage Coal." Mr. C. G. Hall, of the Chicago & Eastern Illinois Railroad, Chicago, Ill., is secretary of the association.

Radio Society of Western Pennsylvania.—More than 150 amateur "wireless" operators and experimenters are members of the newly organized Radio Society of Western Pennsylvania, which holds monthly meetings at the University of Pittsburgh, Pittsburgh, Pa. Dr. Powers, of the school of electrical engineering, will give a series of lectures on recent advances in the technique of wireless operation. The university is also arranging to have its own model wireless station co-operate with amateurs in high schools of western Pennsylvania.

Electrical Contractors' Association of Washington, D. C.—Electrical contractors of Washington, D. C., on April 23 formed a new association for the promotion of trade interests and good fellowship. Mr. Robert Smith, of the Capitol Electric Company, was elected president; Mr. Joseph Randall, of the H. P. Foley Company, was chosen vice-president, and Mr. John J. Odenwald, 1204 H Street, Northwest, was named as secretary. The new association will meet on the first and third Fridays of each month at the Builders' Exchange, 1220 New York Avenue, Northwest.

Empire State Association and Eastern New York Section.—The Empire State Gas & Electric Association and the

Eastern New York Section of the National Electric Light Association will hold a joint meeting at Schenectady, N. Y., on May 6, 7 and 8. The program committee is composed of Messrs. H. M. Beugler, H. W. Peck and E. P. Edwards. The first session will be held on the evening of Thursday, May 6, when an address on "Public Policy" will be made by Mr. James O. Carr, the newly appointed member of the Public Service Commission, Second District, of New York State. At the morning session on May 7 "Hydroelectric Power, Its Generation and Distribution," will be discussed. In the afternoon of the same day Dr. S. W. Stratton, director of the Bureau of Standards, will discuss "The Bureau of Standards as a Factor in Industrial Development." At the dinner to be held at the Mohawk Golf Club in the evening Mr. J. C. DeLong, president of the Empire State association, will be toastmaster. At the morning session on May 8 Mr. John C. Parker, Rochester, N. Y., will lead the discussion on "The Small Consumer—a Problem." The business meetings will be held at the Edison Club.

Facilitating Electric Passenger-Car Operation.—A paper entitled "The Electric Vehicle from a Gasoline Viewpoint" was read at the monthly meeting of the New York Section of the Electric Vehicle Association, April 28, by Mr. David Beecroft, editor of *The Commercial Vehicle*. Mr. Beecroft urged that the central station interests co-operate with dealers and manufacturers and, above all, provide suitable charging facilities for cars. In the discussion which followed, Mr. D. F. Tobias, of the United Electric Light & Power Company, and Mr. Harvey Robinson, of the New York Edison Company, told of their respective companies' efforts to co-operate with the dealers. Messrs. W. J. Miller, D. C. Fenner and R. M. Lloyd also spoke, dealing with some of the problems of the electric vehicle.

New Officers of Iowa Section, N. E. L. A.—Election of officers of the Iowa Section of the National Electric Light Association resulted as follows: President, Mr. E. M. Walker of Dubuque; vice-president, Mr. Thomas Ferris of Osage; secretary-treasurer, Mr. W. H. Thompson, Jr., of Des Moines; executive committee, Messrs. Austin Burt of Waterloo, C. W. Kellogg of Keokuk, Thomas Crawford of Clinton and H. C. Blackwell of Davenport. As noted in last week's issue of the ELECTRICAL WORLD, papers and discussions at the first two days' sessions were devoted particularly to gas-filled tungsten lamps, rural electric service, and general commercial and financial topics. At the morning sessions of the closing day of the convention motion-picture films illustrating safety work occupied the greater portion of the time. In the afternoon, aboard the steamer *G. W. Hill*, the convention party made the trip to Burlington, Ia., holding a business session and question-box discussion en route.

National District Heating Association.—The program for the seventh annual convention of the National District Heating Association, which is to be held at the Hotel Sherman, Chicago, Ill., June 1, 2 and 3, has been announced as follows: Address by the president, Mr. H. R. Wetherell, of Peoria, Ill.; routine business; report of the station record committee, Mr. A. P. Biggs, Detroit, Mich., chairman; "The Commercial End of the Heating Business," by Mr. C. F. Oehlman, of Denver, Col.; address by Mr. Walter A. Shaw, member of the State Public Utilities Commission of Illinois; report of the committee on underground construction, Mr. H. A. Woodworth, Indianapolis, Ind., chairman; "Operating Experience with Bleeder-Type Turbines," by Mr. F. W. Laas, Cedar Rapids, Ia.; paper by Mr. E. F. Tweedy, of New York City; report of the public policy committee, Mr. D. L. Gaskill, of Greenville, Ohio, chairman; address by Mr. J. F. Gilchrist, Chicago, Ill.; report of the educational committee, by Mr. D. S. Boyden, of Boston, Mass.; "The Hot-Water-Heating System at the Grand Central Terminal," by Mr. W. G. Carlton, New York City; report of station-operating committee, Mr. B. T. Gifford, Grand Rapids, Mich., chairman; "A Pressure Study of a Steam Distribution System," by Mr. C. C. Wilcox, of Jackson, Mich.; "Exhaust Steam Versus Live Steam for Heating," by Mr. George W. Martin, of New York City. Committees of Chicago men have been appointed to take charge of the elaborate entertainment features and excursions of inspection planned for the convention. Mr. D. L. Gaskill, of Greenville, Ohio, is secretary of the association.

Public Service Commission News

Idaho Commission

The commission will make its investigation into the reported hydroelectric consolidation of southern Idaho as an agent of the Attorney-General. If the facts developed by the commission are regarded as justifying action, the Attorney-General will proceed against the alleged combination under the Sherman anti-trust law, an act passed in 1911. The commission has cited agents of the Idaho Power & Light Company, the Idaho Railway Light & Power Company, the Idaho-Oregon Light & Power Company, the Great Shoshone & Twin Falls Water Power Company, the Southern Idaho Water Power Company and the Utah Power & Light Company to appear before it.

Indiana Commission

A petition filed by residents in Richmond, Ind., asks authority to begin condemnatory proceedings against the Richmond Light, Heat & Power Company plant, which competes with the municipal plant. The City Council has voted to buy the competing plant, and the commission is asked to fix the terms of purchase. An immediate appraisal is asked, but other pressing business probably will prevent prompt action. City officials contend that the value of the private plant is between $200,000 and $300,000, but the company declares that it is much higher. A hearing has been set for June 15.

Massachusetts Commission

A bill has been enacted by which the commission, after notice and a public hearing, may authorize a municipality which has acquired a lighting plant to extend its mains or lines into an adjoining city or town not at the time supplying gas or electricity. The service may be rendered upon such restrictions as the board may fix, and the municipality supplying service is to have the same privileges and obligations as within its own limits.

Missouri Commission

The property of the Kansas City (Mo.) Electric Light Company has been appraised by the commission engineers and accountants at $4,136,297. Working capital and various other assets claimed by the company were not included in the appraisal. The book value of the company as filed with the commission, including the property appraised by state authorities, working capital and other assets, is $6,129,605. Operating revenues last year were shown to be $2,294,250 and operating expenses $1,787,488, leaving a net profit from operation of $506,762.

New York Commissions

Following the announced reduction in rates of the New York Edison Company, the United Electric Light & Power Company will make substantially the same rates. Its public announcement is to the effect that the maximum rate will be reduced on and after May 1 from 10 cents to 8 cents per kw-hr. Lamp installation and renewal will not be included at this rate, but customers so desiring may obtain lamp service at an additional charge of 0.5 cent per kw-hr. This service includes delivery to premises of the standard renewal lamps of the country, including tungsten lamps of 60 watts and larger. Customers desiring to provide their own lamp service may obtain lamps from the company. The rates covering the different classes of service have also been revised. With the new schedule bulk supply will be furnished only through main meters. Except as may be deemed necessary for efficient metering, only one meter per service per contract will be installed on and after May 1. The new schedule has been filed with the Public Service Commission of the First District.

Ohio Commission

Messrs. Oliver H. Hughes and C. C. Marshall, on the occasion of their retirement from the commission on April 22, joined in a statement to the Legislature to the effect that Ohio will stand indicted for plain theft if it does not turn back to the corporations which paid it the $115,000 which lapsed into the State treasury and which is now needed for physical valuations. They asked the Legislature not to cripple the commission by failing to provide adequate funds for its expense.

Personal

Mr. B. S. Walters, of South Bend, Ind., has been appointed vice-president of the Northern Indiana Gas & Electric Company, succeeding Mr. W. D. Ray, who recently resigned to take up executive duties at Easton, Pa.

Dr. Alexander Chernyshoff, of the Petrograd Polytechnic Institute, Petrograd, Russia, who has been a visitor to industrial plants in the United States, has returned home by way of San Francisco and the Exposition.

Mr. Thomas W. Martin, who has been in charge of legal work for the Alabama Power Company and associated companies since 1912, has been appointed vice-president and general counsel of the company, with headquarters at Birmingham, Ala.

Mr. W. N. Matthews, of St. Louis, Mo., who on April 16 was struck by an automobile while alighting from a street car, is suffering from a broken shoulder blade and from injuries to his head and face. Mr. Matthews is convalescing at his home in St. Louis.

Mr. H. W. Harrison has been elected chairman of the Los Angeles Section of the Electric Vehicle Association, following the resignation of Mr. J. Harry Pieper, of the Southern California Edison Company. Mr. Harrison is southern California representative for the General Vehicle Company.

Mr. Victor H. Tousley, chief electrical inspector for the city of Chicago, has been appointed acting vice-president of the Electric Club of Chicago to fill the vacancy left by the resignation of Mr. W. D. Ray, formerly of Hammond, Ind., who has been appointed general manager of the large power-transmission system at Easton, Pa.

Mr. Harry Clark, who has been new-business manager of the Worcester Suburban Electric Company, Uxbridge, Mass., has been appointed manager of the Union Light & Power Company and the Blackstone Electric Company, which furnish electric service in Franklin, Millville, Blackstone, Foxboro, Bellingham, Attleboro and Mansfield.

Mr. H. G. Fleischauer, general manager of the Washington-Oregon Corporation, Vancouver, Wash., has tendered his resignation to the stockholders, effective May 1. Mr. Fleischauer had been connected with the Washington-Oregon Corporation for a number of years and for the last year and a half has been general manager, having succeeded Mr. A. Welch.

Mr. K. Shofu, president of the Shofu Porcelain Manufacturing Company, Kyoto, and president of the Japan Iron-Stone China Company, Ltd., of Kanazawa, Japan, is visiting America for the purpose of studying the deterioration of high-tension line insulators in this country. He arrived at San Francisco on March 23, and will depart therefrom on May 22. In the meanwhile he is inspecting the high-tension systems between the Pacific and Atlantic Coasts.

Dr. William Marconi arrived in New York on the steam ship *Lusitania* on April 24. He is here to testify in a suit in which the Marconi Wireless Telegraph Company of America charges the Atlantic Communication Company, a subsidiary of the Telefunken Company, with infringement of patents. While here Dr. Marconi also expects to inspect new stations of his company in New Jersey and other places. In the event that Italy enters the war he will return to Europe at once. If he is not called back on account of hostilities, he will remain in this country about three weeks.

Mr. F. M. Tait, president of the Dayton Power & Light Company and past-president of the National Electric Light Association, who will shortly move to New York to become associated with the properties owned by the late Anthony N. Brady, will be the guest of honor at a banquet at Dayton May 11, tendered him by the Dayton Jovian League and by leading business men of the city. Mr. D. L. Gaskill, president of the Greenville (Ohio) Electric Light & Power Company, will preside as toastmaster. Mr. Tait will retain his position as president of the Dayton company, although he will, of course, be unable to give as much personal attention to its operation as heretofore.

Messrs. K. Kimura and Kinji Uchimura, of Osaka, Japan, are making a tour of the United States to study central-station methods and the electric-lamp situation. Mr. Kimura is engineering adviser of the Osaka Electric Light Company and a director of the Osaka Electric Lamp Company. Mr. Uchimura is manager of the Osaka Electric Lamp Company. They had intended to leave Japan in August of last year and to include Europe as well as this country in their tour. Their plans were changed, however, by the war, and they left Japan in February. They have visited San Francisco, Los Angeles, New Orleans and Washington. From New York they plan to go to Boston and Philadelphia, and then to various cities on their return to San Francisco, from which they will sail for Japan two or three months from now.

Mr. Lawrence Addicks, the recently elected president of the American Electrochemical Society, was born on March 3, 1878, at Philadelphia, Pa. He was educated at the University of Pennsylvania and at the Massachusetts Institute of Technology, graduating from the latter institution in 1899 in both mechanical and electrical courses. Soon afterward he went to Mexico to work in a copper mine. From 1900 to 1905 he was assistant to the superintendent of the Raritan Copper Works at Raritan, N. J. From 1905 to 1914 he was associated with the United States Metals Refining Company at Chrome, N. J., first as chief engineer and then for a long period as superintendent. At the present time he is with the Philips-Dodge Company, conducting large-scale leaching experiments on low-grade copper ore at Douglas, Ariz. He has contributed many papers, especially on various phases of electrolytic copper refining, to the American Electrochemical Society, the American Institute of Electrical Engineers, the American Institute of Mining Engineers and other societies.

Mr. E. M. Walker, of Dubuque, Ia., president-elect of the Iowa Section of the National Electric Light Association, is a native of the British Isles, having been born in Nottinghamshire County, England. Coming to America at the age of twelve, he settled with his parents at Lockport, N. Y., and there received his early education. In 1897 he was graduated from Williams College with the degree of bachelor of arts. Upon leaving college Mr. Walker held a position with the Lockport Gas & Electric Company, for which organization his father had charge of the gas works for twenty-five years. About a year later the younger Mr. Walker was made manager of the Dedham & Hyde Park Gas Company at Hyde Park, Mass. He retained this position until 1903, when he became manager of the combined utility property at Bristol, Tenn. and Va. In 1907 he went to Columbus, Miss., serving as engineer for the Columbus Railway, Light & Power Company for a period of a little more than six months. Leaving the South, he accepted a position in Iowa as manager of the Citizens' Railway & Light Company at Muscatine, where he remained until he removed to Dubuque, Ia., to assume managership of the Union Electric Company.

E. M. WALKER

Obituary

J. A. Culverwell, a well-known hydroelectric engineer of Toronto, Canada, died in that city, April 21, at the age of forty-nine. In recent years Mr. Culverwell had been closely identified with the development of the Trent Valley Canal, and had helped in the development of water-powers in central and eastern Ontario, having been connected with the Northumberland & Durham Power Company and the Central Ontario Power Company. As manager of the latter he purchased the Burleigh Falls power, Buckhorn Falls power and power on the Trent Canal. He founded the Northumberland & Durham Power Company in 1906, and was president at the time of his death.

Corporate and Financial

Arizona Power Company, Prescott, Ariz.—The Arizona Corporation Commission has authorized the sale of $250,000 stock for the construction of a power plant and flume.

Atlantic Gas & Electric Company, New York, N. Y.—Holders of the first lien sinking-fund gold bonds, Series A and B, have received notice that a plan for the readjustment of the bonded debt has been adopted by the bondholders' protective committee. The company had $1,666,000 Series A bonds and $807,500 Series B bonds outstanding. The collateral deposited as security for these bonds was purchased by the committee at foreclosure. An agreement has been made whereby the General Gas & Electric Company will acquire a large part of the assets of the company. The committee, therefore, will offer to holders of certificates of deposit for Atlantic A bonds new bonds of the General company of the same face amount and interest. The General company will advance money to the Atlantic company subsidiaries to meet liabilities which were caused by the bankruptcy. Each Series B depositor will receive either cash or notes of the Binghamton (N. Y.) Light, Heat & Power Company equal to 70 per cent of the face amount of his deposited holdings. Those who do not participate in the plan will be entitled to their respective pro rata share of the proceeds of the foreclosure sale, which, it is estimated by the committee, will not exceed $112 per bond of $1,000 face value.

Cleveland (Ohio) & Eastern Traction Company.—A meeting of the stockholders has been called for May 3 for the purpose of amending the charter to permit the sale of energy. The company purchases energy from the Cleveland Electric Illuminating Company and wishes to sell the excess to private users.

Connecticut River Power Company, Brattleboro, Vt.—The $500,000 issue of five-year 7 per cent notes has been authorized by the Public Service Commissions of Vermont and New Hampshire, in which the company operates. The Vermont commission authorized the issue of the entire amount, while the New Hampshire commission authorized the issue of $236,000, representing the part of the company's property which is situated in that State. The proceeds from the part authorized by the New Hampshire commission are to be used to pay or refund the portion of the note issue of April 1, 1910, which represents $204,158 debt incurred in acquisitions or improvements in the State and $20,042 floating debt for construction and improvements.

Kansas City (Mo.) Railway & Light Company.—The receivers have petitioned the United States District Court for funds to meet $2,427,865 necessary maintenance and construction costs of 1915.

Long Acre Electric Light & Power Company, New York, N. Y.—A decision has been rendered by Justice Guy of the State Supreme Court in the action brought by minority stockholders of the Manhattan Transit Company against the Inter-City Power Company, Harvey Fisk & Sons, A. B. Leach & Company and certain directors of the Manhattan Transit Company to set aside a contract by which the transit company undertook to dispose of the stock of the Long Acre Electric Light & Power Company. The court holds that the contract was fair and made in good faith, and that there was no ground on which the transaction or the conduct of the defendants could be attacked properly. This decision, it is announced, sustains the rights of the Inter-City Power Company with respect to the stock of the Long Acre Electric Light & Power Company and the rights of the defendants as holders of bonds and stock of the Inter-City Power Company. Unless reversed by a higher court, it is stated, this decision will establish the status of the enterprise and remove the legal obstacles in the way of development and financing of the Long Acre Electric Light & Power Company.

Martinsburg (W. Va.) Power Company.—Acting upon the petition of non-resident security holders, Messrs. H. H. Emmet and C. E. Martin, of Martinsburg, and James H. Harlow, of Darlington, Md., have been appointed receivers for the company by Judge Dayton of the United States Circuit Court. The receivers will proceed with the reorganization and financing of the company in accordance with an agreement entered into with Messrs. Day & Zimmerman, of Philadelphia.

Pacific Gas & Electric Company, San Francisco, Cal.—The company has filed an application with the California Railroad Commission requesting authority to pay a dividend on the common stock. Between Jan. 1, 1914, and April 1, 1915, the company retired $849,500 bonds through payments into sinking funds. During the remainder of 1915 the company will be required to retire $1,461,000 additional bonds. All of the above payments have been made, or will be made, out of net earnings or surplus profits, and the company wishes to capitalize these payments by the issuance of a common stock dividend. This dividend, it is proposed, shall consist of as many shares of its unissued common capital stock as shall be equal to the amount of net earnings or surplus profits which the board of directors shall determine to capitalize permanently, but not exceeding 6 per cent of the common capital stock now in the hands of the public.

Portland (Ore.) Railway, Light & Power Company.—Arrangements have been made for the payment of the $5,000,000 of 5 per cent one-year gold coupon notes due on May 1, 1915, by the sale of a like amount of 5 per cent gold notes maturing on May 1, 1917, to Messrs. E. W. Clark & Company of Philadelphia and their associates, who will purchase at par such one-year notes as may be presented on or before May 1, 1915. Of the new notes, $4,500,000 have already been sold or exchanged and the balance are offered at 98 and interest. The notes are secured by deposit of the entire issue of $5,000,000 first mortgage sinking-fund thirty-year gold bonds of the Mount Hood Railway & Power Company, due in 1937, and of the entire capital stock, excepting directors' shares, of the Mount Hood company. For the twelve months ended Dec. 31, 1914, the following earnings are reported:

Gross earnings	$6,273,171
Operating expenses (including taxes)	3,263,883
Net earnings	$3,009,288
Interest, rentals, amortization of bond discount, etc.	1,922,678
Balance	$1,086,610
5 per cent interest on $5,000,000 notes	250,000
Balance available for renewals, depreciation, dividends, etc.	$836,610

Sandusky River Power Company, Fremont, Ohio.—The property of the company is to be sold to satisfy mortgages securing bond issues aggregating $375,000, under which the Cleveland Trust Company is trustee.

Santa Barbara (Cal.) Gas & Electric Company.—The California Railroad Commission has issued a supplemental order authorizing the company to issue $10,000 of first mortgage 6 per cent thirty-year gold bonds. These bonds are a portion of the $100,000 issue of bonds which the company was authorized by the Railroad Commission to issue on Feb. 27, 1915.

Vinalhaven (Maine) Electric Company.—The Maine Public Utilities Commission has granted permission for the issue of $30,000 of capital stock at par and $30,000 of first mortgage 6 per cent twenty-year gold bonds at not less than 90, to pay for construction and the acquisition of property and franchises.

Western Canada Power Company, Ltd., Montreal, Canada.—At a meeting to be held on May 7, 1914, the shareholders will be asked to approve an increase in the capital stock from $5,000,000 to $10,000,000. A new issue of $5,000,000 of 7 per cent cumulative preferred stock will be created. It will be convertible into common stock. The company found it impracticable to sell the $1,000,000 additional first mortgage bonds authorized last December. The preferred stock issue will be created in the hope, it is stated, that should the financial stringency be prolonged the holders of certain of the mortgage securities now outstanding may decide eventually to convert these securities into preferred shares.

York Railways Company.—The Pennsylvania Public Service Commission has approved the application to purchase certain securities of the Merchants' Electric Light, Heat & Power Company, of York, Pa.

Manufacturing and Industrial

The Capital Electric Company has moved from 231 Insurance Exchange Building to 321 North Sheldon Street, Chicago, Ill.

Mr. C. W. Humphrey, consulting and designing engineer, has moved his office from the Rookery Building to the Webster Building, 327 South La Salle Street, Chicago, Ill.

The Speer Carbon Company, St. Mary's Pa., has begun the construction of a building, 60 ft. by 150 ft., which will be devoted to the manufacture of motion-picture electrodes.

Mitchell & Allen.—Messrs. Robert C. Mitchell and Robert Starr Allyn have formed a partnership for the soliciting of patents for electrical and other inventions and the practice of law. The headquarters of the firm will be at 41 Park Row, New York.

The Fearn Company.—Vulcanizers made by the Fearn Company, 206 North Frederick Street, Baltimore, Md., are being sold only by the Flaherty Manufacturing Company of Baltimore, Md. It was erroneously stated in the ELECTRICAL WORLD of April 24 that the Flaherty Company had obtained the right to manufacture these devices.

The Benjamin J. Glaser Realty & Engineering Company is the new name adopted by the British-American Company, 1003 City Hall Square Building, Chicago, Ill. The new company continues at the same address, where it is engaged in the financing, building and construction of hydroelectric plants and electric railways.

Mr. Ernest E. Lee, formerly principal assistant electrical and mechanical engineer of the Panama Canal, announces that he has opened offices at 638 Marquette Building, Chicago, and has acquired exclusive rights to manufacture and sell electric radiators employing the Apfel system of electric heating in the Central Western States. The radiators will probably be manufactured in Chicago.

Motors for French Company.—The Wagner Electric Manufacturing Company, 6400 Plymouth Avenue, St. Louis, Mo., recently completed the shipment of about 600 polyphase motors of various sizes for the L'Eclairage Electrique, Paris, France. These motors are to be utilized, it is reported, for driving American machine tools installed in an ammunition manufacturing plant at Lyons, France.

The H. W. Johns-Manville Company, Madison Avenue and Forty-first Street, New York, has made an arrangement, which goes into effect May 1, to market the lighting equipment manufactured by the Mitchell Vance Company. A showroom will be established at 294 Madison Avenue, New York, May 15, adjoining the H. W. Johns-Manville Building, in which the various types of lighting fixtures made by the Mitchell Vance Company will be placed on display.

The George Cutter Company, South Bend, Ind., has opened a New York office at 30 Church Street, New York City, in charge of Mr. Dean K. Chadbourne as district manager. Mr. Chadbourne formerly had charge of sales work west of Pittsburgh for the company, and while in that field was responsible for equipping a number of Middle West towns and cities with modern street-lighting apparatus. The New York office includes a sample room for the display of the George Cutter Company's lines of street-lighting and wiring specialties.

Edison Plant Rebuilt and Busy Again.—Although it is but eighteen weeks since the disastrous fire that swept through the Edison plant at West Orange, N. J., the damage done has now been entirely repaired and additional buildings have been erected. Practically all of the 7000 employees who were thrown out of work at the time of the fire are back again at their respective tasks. Several representatives of European powers recently paid a visit to the Edison storage-battery plant for the purpose of studying the manufacture of batteries for submarines.

Electric Pumps for Dry Dock.—Six 10-in. Morris centrifugal pumps operated by 20-in. Westinghouse vertical motors were recently added to the equipment of the S. O. Smith Shipbuilding & Dry Dock Company for the operation of its dry dock at Norfolk, Va. Twelve units with similar ratings had previously been installed, making a total of eighteen pumping units. With this equipment it is said to be possible to lift a vessel high and dry in seventeen minutes at an energy cost of about $4.50. The dock is designed to take vessels with a length of 260 feet or less and a total weight of 3000 tons or less.

Scrubbing Machines Valuable to Jewelry Manufacturers.—The Wilbur B. Allen Company, 34 West Thirty-third Street, New York, reports that there is a demand from jewelry manufacturers and copper workers for floor-scrubbing machines which pick up dirt and débris. With these machines, it is claimed, the manufacturers recover a large amount of valuable metal which drops to the floor. The company named above is sole selling agent for the electric scrubbers made by the Sanitary Scrubbing Company, also of 34 West Thirty-third Street, New York. One of the company's machines was described in the ELECTRICAL WORLD of Nov. 7, 1914.

Extensive Use of Vacuum Cleaners in Printing Establishments.—Mr. L. W. Ferrell, of the Vacuna Company, 29 Broadway, New York, recently stated to a representative of the ELECTRICAL WORLD that a number of vacuum cleaners are being used in printing plants for cleaning printing presses, paper cutters, folders, type cases and printed stock which has been bronzed. Mr. Ferrell said that May is the best month of the year for the business of his company. The demand for vacuum cleaners at this time of the year, he asserted, is great because of the almost universal belief of housewives that spring is the time for thorough housecleaning, although, as vacuum cleaners come to be more generally used, people will realize that such periodic upheavals in the household are unnecessary.

Opportunities Good for Electrical Products of American Manufacture in Scotland.—In a commercial report by Consul John M. McCunn on Scotland it is stated that there was never a better time for manufacturers of electrical goods to establish permanent business connections in Scotland than the present. Mr. McCunn warns manufacturers to consider the local and individual requirements, however. Business in the country is worth striving for, he declares, because in the near future British makers cannot possibly cope with the demand. With a view to establishing trade he suggests that American manufacturers get in touch with reliable firms that can buy on their own account. There are a number of firms, Mr. McCunn asserts, which can afford and are willing to pay for what they order. Everything electrical is wanted, and the demand for domestic appliances especially is increasing daily.

The Dey Electric Corporation, 45 Broadway, New York, has recently been incorporated and has taken over the Dey Electric Vehicle Syndicate, also of 45 Broadway, New York. The corporation proposes to manufacture a light-weight, low-priced electric vehicle. This car is to be operated by a motor equipped with revolving field and revolving armature in the rear axle as described in the ELECTRICAL WORLD of April 3. The location of the company's factory for building these vehicles has not been decided upon. Mr. Max E. Schmidt, the president of the corporation, is also president of the Continuous Transit Securities Company. Mr. H. W. Hillman, formerly of the sales department of the General Electric Company and the General Vehicle Company, is vice-president and treasurer. Mr. Henry E. Dey is engineer, and Dr. C. P. Steinmetz is consulting engineer for the company.

Exports of Material for Building.—A special compilation which enumerates representative articles for use in building construction exported from the United States has just been brought out by the Bureau of Foreign and Domestic Commerce, Department of Commerce. For the fiscal year 1914 these products were valued at approximately $150,000,000, although since the outbreak of the European war there has been a marked decrease in the exports of these products. It is anticipated that after the conclusion of the war there will be a greatly increased demand for material of this kind. The following list includes some of the articles of electrical interest which were exported during the fiscal year 1914 for use as building material or as factory and house furnishings, and gives their value: Pipes and fittings made of wrought iron, $14,337,973; chandeliers, etc., $2,806,036; dynamos, etc., $2,634,365; transformers, $1,455,343; telephones, $1,552,951; interior-wiring fixtures, $721,069; batteries, $685,640; electric fans, $432,656; electric lamps, $468,269; fire extinguishers, $109,573.

Disposing of Used Electric Cars.—The New York Electric Vehicle Association has a number of used electric pleasure cars in its garage at Central Park West and Sixty-second Street, which have been overhauled and are being sold under a guaranty. The association also expects to acquire a number of used electric trucks in the near future, and will endeavor to dispose of them under assurances to purchasers like those now given with the used pleasure vehicles.

Good Lamps and Good Service.—Lamps sold to consumers during the last year by central stations showed by test that in average length of life they were well within the standard specifications. Of the lamps distributed to the public by others than central stations only 42 per cent were up to standard, said Mr. Preston S. Millar, general manager of the Electrical Testing Laboratories of New York City, before the Minnesota Electrical Association, in explaining to the central-station men present that, although they might have a good power house, a well-maintained distribution system and a competent engineering force, their lighting service cannot attain its highest efficiency until some attention is given to the lamp situation. The central station which does not to some extent interest itself in the lamps being distributed to its consumers, declared Mr. Millar, is courting trouble. Lamps are a commodity in the sale of which there is the possibility of many abuses, and therefore the central station should see that the lamps are properly handled for the ultimate good of both the consumer and the lighting company.

Three-Quarter Million Gas-Filled Tungsten Lamps Sold to Date.—Since gas-filled tungsten lamps were first placed on the market, only about a year ago, 375,000 of these high-efficiency units have been sold. These lamps, according to an estimate presented by Mr. Henry Schroeder, of Harrison, N. J., in a paper read before the Iowa Section of the National Electric Light Association, have been the source of more than $15,000,000 of increased revenue to the lighting companies during the past year. Other data given by Mr. Schroeder on the total lamp sales for the United States are presented in the accompanying table. These figures show in an interesting manner the healthy growth in total lamp sales and the increasing popularity of the tungsten-filament lamp.

NUMBER OF LAMPS SOLD IN THE UNITED STATES

Year	Carbon	Gem	Tungsten Filament	Total
1908	51,000,000	4,000,000	4,000,000	60,000,000
1910	47,000,000	6,000,000	12,000,000	75,000,000
1912	23,000,000	31,000,000	36,000,000	90,000,000
1914	8,000,000	22,000,000	70,000,000	100,000,000

NEW YORK METAL MARKET PRICES

	April 20 Selling Prices Bid	April 20 Selling Prices Asked	April 27 Selling Prices Bid	April 27 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot*	75 15 0		81 5 0	
Prime Lake	17.50	to 17.75	18.62½	to 18.87½
Electrolytic	17.12½	to 17.37½	18.50	to 18.62½
Casting	16.75		17.75	to 18.00
Copper wire base	18.50		19.87½	
Lead	4.20		4.20	
Nickel	42.00	to 45.00	42.00	to 45.00
Sheet zinc, f.o.b. smelter	13.50		14.50	
Spelter	11.25†		14.00†	
Straits tin	46.00†		42.00†	
Aluminum, 98 to 99 per cent	18.75		18.75	to 19.00

*OLD METALS

Heavy copper and wire	15.50	17.00
Brass, heavy	10.50	11.00
Brass, light	8.75	9.00
Lead, heavy	3.95	3.95
Zinc, scrap	8.50	9.50

*COPPER EXPORTS

Total tons to April 27	14,478

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Incorporations

The Hammond Light & Power Company, of Hammond, N. Y., has been granted a charter with a capital stock of $25,000. The incorporators are Milton Soper, W. S. Soper and F. H. Bertrand, all of Hammond, N. Y.

The Hell Gate Canyon & Coquille Power Company, of Grant's Pass, Ore., has been incorporated by George E. Sanders and George W. Sorenson, of Grant's Pass, and Wharton Plummer, of Chicago, Ill. The company is capitalized at $1,000,000, and proposes to build a power plant to supply electricity in the city of Grant's Pass for irrigation and other purposes.

New Industrial Companies

The Universal Electric Company, of Detroit, Mich., has been incorporated with a capital stock of $15,000 to manufacture and deal in electric vacuum cleaners and washing machines.

The Standard Electric & Manufacturing Company, of Pittsburgh, Pa., has been incorporated with a capital stock of $10,000 by Benjamin Raphael, Max I. Amdursky and Joseph Goldstein, all of Pittsburgh, Pa.

The Bijou Lighting Fixture Company, of New York, N. Y., has been incorporated by J. Snyder, Max and Leopold Zelinka, 2605 Eighth Avenue, New York, N. Y. The company is capitalized at $5,000 and proposes to manufacture gas and electric-light fixtures.

Trade Publications

Geared Turbines.—The Kerr Turbine Company, Wellsville, N. Y., has recently issued Bulletin No. 51, which is entitled "Economy Geared Turbines."

Wiremen's Gasoline Blow-Torch.—The Carleton Company, 170 Summer Street, Boston, Mass., has issued a card which contains information on a gasoline blow-torch for wiremen.

Low-Priced Electric Truck.—The Ward Motor Vehicle Company, Mount Vernon, N. Y., has prepared an illustrated folder which describes its light-weight, low-priced electric truck.

Electric Lanterns.—Several types of electrically operated lanterns are described and illustrated in a catalog just issued by the Burchwell Manufacturing Company, St. Louis, Mo.

Lock Attachment for Ignition System Switch.—The Connecticut Telephone & Electric Company, Meriden, Conn., has prepared a leaflet which contains information on a lock for ignition-system switches.

One-Piece Steel Poles.—The Bates Expanded Steel Truss Company, 208 South La Salle Street, Chicago, Ill., has published an illustrated catalog describing its one-piece pole and transmission-line structures.

Electric Washing Machines.—The Automatic Electric Washer Company, Newton, Ia., has issued an illustrated catalog which contains information on several types of electric washers and on its selling helps for the dealer.

Stage-Lighting Apparatus.—The Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York, has prepared a catalog on electric stage lighting. The company has also published a booklet on the lighting of studios.

Testing Liquid-Flow Meters.—The Harrison Safety Boiler Works, Philadelphia, Pa., have issued engineering Leaflet No. 18, entitled "Laboratory for Investigating and Testing Liquid-Flow Meters of Large Capacity." This is a reprint of a paper read at the annual meeting of the American Society of Mechanical Engineers in December by Mr. W. S. Giele.

Heating Appliances.—The Hotpoint Electric Heating Company, Ontario, Cal., has issued a catalog, entitled "Home Book of Electricity," which contains information on a number of different types of electrically operated heating appliances. The company has also issued booklets entitled "Pocket Reference Book for Lighting Companies' Appliance Salesmen" and "Appliance Handbook for Central Stations."

Construction News

New England

CARMEL, MAINE.—Plans are being considered by the Black Stream El. Co., recently organized, to build an electric plant to supply electricity in the towns of Carmel, Hermon, Levant, and possibly Etna. The cost of the proposed plant is estimated at $25,000, and it will probably be located on what is known as the Damon mill on the Sowadabscook stream, about 1 mile west of Carmel station.

OQUOSSOC, MAINE.—Steps have been taken toward the organization of a company, to be known as the Oquossoc Lt. & Pwr. Co., for the purpose of supplying electricity for lamps and motors in Oquossoc. The power is to be obtained from Kennebago Falls, about 10 miles from Oquossoc. F. B. Colby, H. C. Riddle, John A. Russell and others are interested.

BURLINGTON, VT.—The Burlington Lt. & Pwr. Co. expects to erect the power station at Essex Junction for its new plant within the next four months; the dam and headgates were built last year. Material has all been purchased. F. H. Parker is manager.

HAVERHILL, MASS.—The Haverhill El. Co. has applied to the City Council for permission to lay underground conduits in Emerson Street from Washington to Walnut Street.

LOWELL, MASS.—The City Council has decided to grant the petition for extensions of the ornamental lighting system in Merrimac and Middlesex Streets.

NANTUCKET, MASS. — The Citizens' Gas, El. & Pwr. Co., of Nantucket, has recently purchased a 100-kw General Electric turbine, condenser and boiler and 31 "Novalux" type nitrogen street lamps. H. P. Halvorson is superintendent.

Middle Atlantic

BROOKLYN, N. Y.—Bid will be received by L. H. Pounds, president of the borough of Brooklyn, Room 2, Borough Hall, Brooklyn, until May 5, for making alterations and repairs, including electric work, at the Lorimer Street comfort station, borough of Brooklyn. Blank forms and further information may be obtained and plans may be seen at the office of the Bureau of Public Buildings and Offices, 50 Court Street, Brooklyn.

BUFFALO, N. Y.—The Buffalo General Electric Co. expects to purchase within the next six months rectifiers, etc., amounting to $12,000; switches and regulators, $25,000; wire and cable, $15,000; appliances, $9,000, and lamps, $12,000. Roscoe McMillan is statistician.

CANANDAIGUA, N. Y.—The City Council has entered into a contract with the Ontario Lt. & Trac. Co., of Canandaigua, to supply electricity to operate the waterworks pumping plant. Under the terms of the contract the company agrees to install the electrical equipment at the pumping station, at a cost of about $12,000.

FULTON, N. Y.—The Fulton Lt., Ht. & Pwr. Co., expects to purchase within the next three months 100 irons, six washing machines and 12 fans. J. J. Jordan is general manager.

ITHACA, N. Y.—The installation of an ornamental lighting system in the business district is under consideration.

LAKE PLACID, N. Y.—The Public Service Commission has granted its approval of the extension of the electric-lighting service of the village of Lake Placid to several adjacent sections of the town of North Elba, which include the Whiteface Inn district, the Peninsula and Saranac Avenue district, the Placid Heights district, the Averyville district and the Newman district.

NEW YORK, N. Y.—The contract for gas and electric fixtures for the main building and ward wing extension of the Harlem Hospital has been awarded to the Shipley Construction & Supply Co., Columbia Street, Brooklyn, N. Y., at $7,250.

NEW YORK, N. Y.—The Public Service Commission has awarded the contract for the construction of Section No. 2 of Route No. 12 to the Inter-Continental Construction Co., at $2,744,263. This section is in Eastern Parkway, Brooklyn, extending from Prospect Park Plaza to a point 600 ft. east of Nostrand Avenue.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, Municipal Building, New York, until May 4, for furnishing and installing electric-lighting system in quarters of hook and ladder company No. 6 and engine companies Nos. 9, 11, 15, 21 and 25, Manhattan, and engine company No. 70, the Bronx. Blank forms and further information may be obtained and plans and drawings may be seen at the office of the Fire Department, eleventh floor, Municipal Building.

NEW YORK, N. Y.—The Board of Estimate has adopted a resolution authorizing the Mayor to execute a contract granting a franchise to the New York Edison Co. and subsidiary electric companies of the Consol. Gas Co. to construct, maintain and operate transmission lines over the Catskill Aqueduct lands for the purpose of supplying electricity for a period of 25 years, in return for which the lessees will supply to the city without cost all electrical energy required for working, lighting and pumping siphons along the route of the new aqueduct.

EBENSBURG, PA.—Within the next 30 days the Ebensburg Lt., Ht. & Pwr. Co. expects to install one 800-hp Blake & Knowles open feed-water heater and one Worthington duplex feed pump. Charles S. Evans is president.

HARRISBURG, PA.—The installation of electrical equipment to replace some of the steam-driven machinery is under consideration by the Harrisburg Pipe & Pipe Bending Works in connection with the proposed extension to its plant. Negotiations have been closed with the Harrisburg Lt. & Pwr. Co. for the substitution of electrical power by Jan. 1, 1916. About 2500 hp will be required.

HARRISBURG, PA.—Bids will be received by the Board of Commissioners of Public Grounds and Buildings of the Commonwealth of Pennsylvania, Harrisburg, until May 11 for furnishing supplies for Executive Mansion, the Legislature, the several departments, boards and commissions of the State government, as follows: Engineering instruments, laboratory and engineering supplies, hardware supplies, and for furnishing light, heat and power supplies. Blank bonds and schedules containing necessary information may be obtained upon application to Samuel B. Rambo, superintendent public grounds and buildings.

LEHIGHTON, PA.—The Lehighton El. Lt. & Pwr. Co. expects to purchase within the next three months one Stirling water-tube boiler, 180 boiler tubes, three sets arch bricks and inside firebrick, one 250-kw, two-phase, 60-cycle alternator, 35 5 amp, 120-volt Bot. Conn. glass-covered meters, two 2½-kw and four 5-kw transformers. L. B. Horne is manager.

MAHAFFEY, PA.—The Susquehanna El. Co., of Mahaffey, Pa., is contemplating replacing the carbon street lamps now in use with "Mazda" lamps. F. J. Anderson is manager.

MARTINSBURG, PA.—Steps will be taken immediately by the receivers of the Martinsburg Pwr. Co. for reorganizing and financing the company in accordance with the agreement made with Day & Zimmerman, of Philadelphia, representing the stockholders. The name of the company will be changed to the Potomac Lt. & Pwr. Co., and the capital stock will be increased to $1,000,000. It is also proposed to enlarge the two plants on the Potomac River and the one in Martinsburg. H. H. Emmert, C. E. Martin, of Martinsburg, and James H. Harlow, of Darlington, Md., are receivers.

MEDIA, PA.—The Borough Council is considering calling a special election to submit the proposal to authorize an appropriation of $70,000 for the erection of a sedimentation basin and other improvements to the filtration system and to the municipal electric-light plant. New pumps, new boilers and other equipment is needed. It is proposed to install electric motor-driven pumps.

PITTSBURGH, PA.—The contract for the mechanical equipment for the laboratory building of the Bureau of Mines at Pittsburgh has been awarded to the Standard Engineering Co., of Washington, D. C., at $63,350.

POTTSVILLE, PA.—The Eastern Pennsylvania Lt., Ht. & Pwr. Co., of Pottsville, is contemplating increasing the output of its Palo Alto plant by 2000 hp, at a cost of about $200,000.

SHIPPENSBURG, PA.—The Shippensburg Gas & El. Co. is installing a hydroelectric power plant, which will have a generating capacity of 450 kw. The plant will be completed about July 1, 1915. C. W. Harman is superintendent.

WATERFORD, PA.—Within the next 45 days the Waterford El. Lt. Co. expects to build a substation with an output of 125 kw to take energy from the 33,000-volt transmission line being erected from East Corry. The company has already placed contracts for three 50-kw Westinghouse 33,000-volt transformers, together with the necessary air-break switches, lightning arresters, etc. B. E. Waltz is treasurer and superintendent.

WILKES-BARRE, PA.—Plans, it is reported, have been completed by the Lehigh & Wilkes-Barre Coal Co. for the erection of a large power plant and shops near the Empire Colliery, Georgetown, to cost about $200,000. The plant will supply power for several collieries near by.

HIGHTSTOWN, N. J.—Mayor Thomas is promoting a plan to install a municipal electric-lighting plant in Hightstown.

VENTNOR CITY, N. J. (not a post office)—The City Council has authorized the installation of lamps erected on new ornamental iron standards the entire length of the Ventnor Boardwalk.

WOODSTOWN, N. J.—Within the next 30 days the Woodstown Ice & Cold Storage Co. expects to purchase one 100-kw, 60-cycle generator with switchboard and instruments; also to purchase within the next six months 25 lightning arresters, 25 watt-hour meters and 4000 lb. of wire; also a few irons and vacuum cleaners. The company is changing its system from 133 cycles, single-phase, to 60 cycles, three-phase. The company will dispose of the 133-cycle equipment. C. F. Moore is treasurer.

LAUREL, DEL.—A deal has been consummated for the consolidation of the Sussex Lt. & Pwr. Co., of Laurel, the Salisbury Lt., Ht. & Pwr. Co., of Salisbury, the Cambridge Gas, El. Lt. & Pwr. Co., of Cambridge, Md., the Georgetown Lt., Ht. & Pwr. Co., of Georgetown, the Milton Lt., Pwr. & Wtr. Co., of Milton, and several smaller lighting and power companies. The new company will be capitalized at $1,000,000. The various towns will receive electrical service from a central plant, probably located at Laurel. Jesse E. D. Price and William M. Cooper, both of Salisbury, Md., are interested in the new company.

BALTIMORE, MD.—The Board of Estimates has authorized the Water Board to prepare specifications for the installation of an electrically driven centrifugal pump (with daily capacity of 25,000,000 gal.) at the Eastern pumping station, to cost approximately $25,000.

MYERSVILLE, MD.—The Hagerstown & Frederick Ry. Co., of Hagerstown, is contemplating the installation of a substation in Myersville.

PARKERSBURG, W. VA.—The site has been decided upon for the proposed new electric generating station of the Parkersburg, Marietta & Interurban Ry. Co., plans for which have been prepared by Sanderson & Porter, 52 William Street, New York, N. Y. The building will be 135 ft. by 150 ft. and will cost about $500,000. No contracts have been let as yet for either the construction or equipment.

WILLIAMSON, W. VA.—Preparations are being made by the Norfolk & Western Ry. Co. to equip the entire Pocahontas division for electrical operation. Electric motors are already in service hauling trains over Bluestone Mountain.

CLIFTON FORGE, VA.—Within the next five months the Virginia Western El. Co., of Clifton Forge, expects to build a hydroelectric plant, five substations, and erect 42 miles of 44,000-volt, three-phase transmission line; also to purchase within the next three months three waterwheel governors and three 600-kva generators, etc. A. H. Grimsby is chief engineer.

SHENANDOAH, VA.—Within the next 12 months the managers of the municipal electric-light plant expect to purchase some lightning arresters. J. A. Booton is superintendent.

WASHINGTON, D. C.—The sale of general improvement bonds to the amount of $79,500 has been authorized by the Potomac El. Pwr. Co., of Washington, D. C., to provide funds for the following work: Extension of underground conduits for street and park lighting, $7,262; extension of underground cables for same, $24,262; additional street lamps, $5,715, and for extension to street-lighting system for 1915, $42,000.

WASHINGTON, D. C.—Bids will be received by the Secretary of the Interior, Department of the Interior, Washington, D. C., until May 11, for furnishing material and labor required for rewiring the third floor and galleries of the Patent Office Building, Washington, and making all connections ready for service in accordance with plans and specifications, copies of which may be obtained upon application to the chief clerk of the department.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 11 for furnishing at the various navy yards and naval stations supplies as follows: Brooklyn, N. Y., Schedule 8213—alternating-current and direct-current dynamotors, one telephone motor-generator, one ship's telephone switchboard, miscellaneous fire-control and maneuvering telephones. Newport News, Va., Schedule

8214—miscellaneous rigging telephone dynamotors, one telephone talking motor generator, miscellaneous telephones, spare parts, etc., 118 fire-control telephones. Washington, D. C., Schedule 8205—miscellaneous pyrometers, electric indicator and recorders. Brooklyn, N. Y., Newport News, Va., Schedules 8213-8214—miscellaneous telephone jacks, two fire-control telephone switchboards; Schedule 8214—two battery-charging panels. Norfolk, Va., Schedule 8211—one rotary shear, complete with motor and circular cutting extension.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 14,416—An American consular officer in the United Kingdom has been furnished with a list of electrical articles which are finding ready sale in that country, which include electrical cables insulated with vulcanized rubber, hard-drawn copper wire, pocket flashlamps and similar goods, opal-glass shades, enameled-iron shades, dry batteries for telephones and other purposes, arc-lamp carbons and electrical incandescent lamps and electrical cooking devices. No. 14,421—An importing firm in southern Europe advises an American Consul that it wishes to get in touch with American manufacturers of electrical supplies. No. 14,422—A firm in the United Kingdom informs an American consular officer that it is in the market for all classes of opal, glass and enamel-iron shades, insulating materials, such as black adhesive tape, half-proofed tape, Chatterton's compound, shellac and manila paper, suitable for use in the manufacture of electrical cables. This firm is also a buyer in large quantities of electrical china insulators. No. 16,428—A firm in Italy informs an American consular officer that it desires to receive catalogs, prices, etc., from American firms manufacturing electrical supplies and electric motors, etc. No. 16,436—An American consular officer in Latin America reports that it is understood that a concession for an electric light and power plant for a town of 7000 inhabitants will be let to an American corporation in the near future. The corporation, it is stated, now controls a number of public utilities. No. 16,451—This bureau is in receipt of a letter from a business firm in the United States transmitting a communication from a firm in Switzerland which desires to purchase electric wires and ribbons. Samples are requested. No. 16,454—A business man in Spain desires to communicate with American manufacturers and exporters of copper wire, ingots and sheets for the manufacture of dynamos, motors, etc., and material for insulating the wire, etc. No. 16,548—This bureau is in receipt of a letter from a foreign consul in New York City requesting names and addresses of manufacturers of searchlights of 60 cm in diameter. No. 16,555—An American consular officer in China transmits a report relative to an opportunity for the sale of electrical supplies. A pamphlet relative to this opportunity may be examined at the Bureau of Foreign and Domestic Commerce or its branch offices. No. 16,458—An American consular officer in one of the neutral European countries writes that a firm in his district desires to receive offers from American manufacturers who are in a position to deliver electric searchlights for military purposes. No. 16,493 — A commercial organization in Russia informs an American consular officer that it desires to represent American manufacturers of electric lamps, steam engines, motion-picture machines, etc. No. 16,531—One of the foreign legations in Washington informs this bureau that a manufacturer of electrical foot warmers is in the market for the necessary wire. He needs fine nickeline excelsior and chrome-nickel wire of great electrical resistance, sizes 0.05 mm to 3 mm. A pamphlet illustrating the foot warmers may be seen at this bureau and its branch offices. No. 16,517—A manufacturer in Switzerland informs an American consular officer that he desires to communicate with American manufacturers of electrical heating and cooking apparatus and electrical soldering apparatus. No. 16,446—An American consular officer in Spain reports that a business man in Africa desires to import X-ray apparatus and paper clips. Correspondence and catalogs should be in Spanish. Further information may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch office.

North Central

ANN ARBOR, MICH.—Tentative estimates have been submitted to the City Council by Manley Osgood, city engineer, for the installation of a municipal electric-light plant to supply electricity for lighting the streets and public buildings. The cost of the proposed plant is placed at $55,585.

DETROIT, MICH.—The Hudson Motor Co. has awarded contracts for an addition to its power plant. New machinery will also be installed.

DETROIT, MICH.—Within the next three months the Public Lighting Commission expects to purchase poles, cross-arms, weather-proof wire, glass insulators, steel strand and hardware for 500 new arc lamps. Frank Mistersky is superintendent.

DOWAGIAC, MICH. — Preparations are being made by the Board of Public Works for improvements to the municipal electric-light plant, contracts for which will be awarded some time this month. The plans call for the installation of a 150-kw, three-phase, 60-cycle, 2300-volt (engine-type) 200 or 225 r.p.m. generator and switchboard and one series regulator (6.6 amp) for "Mazda" lamps. Also engine with rating of 150-kw engine ("unaflow" type). The board would like to receive estimates and information from manufacturers of this type of engine. William E. Reynolds is superintendent.

HANOVER, MICH.—Henry Schlegelot, of Lapeer, it is reported, is contemplating the installation of an electric-lighting plant in Hanover.

CINCINNATI, OHIO—Messrs, Zettel & Rapp, architects, Johnston Building, Cincinnati, have been engaged by P. A. Henry, 713 Sycamore Street, to prepare plans for the erection of a six-story reinforced-concrete power building, to be located at Eighth Street and Broadway and to cost about $125,000.

CLEVELAND, OHIO.—Plans are being considered by the Detroit Avenue Business Men's Association for installing an ornamental lighting system on Detroit Avenue N. W. between West Forty-fifth Street and West 102d Street.

CLEVELAND, OHIO—The executive committee of the Ohio State Tel. Co. has voted an additional expenditure of $136,516 for extensions and improvements, as follows: Improvements and extensions at Alliance, $96,000; Akron, $2,750; Canton, $2,000; Youngstown, $450,000; Columbus, $50,000; Dayton, $50,000; Washington C. H., long-distance lines, $35,000; long-distance circuits, $25,000, and two stations in Cleveland, to cost several hundred thousand dollars, one on the west side at West Sixty-fifth Street and Lorain Avenue, and one in Lakewood.

CLEVELAND, OHIO—Bids will be received by A. R. Callow, commissioner of purchases and supplies, Room 511, City Hall, Cleveland, Ohio, until May 7 for rotary converters, transformers and switching equipment for the municipal electric-light plant, in accordance with specifications which may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street, Cleveland. Bids will also be received at the same time and place for constant-current transformers and switching equipment and for lamps and glassware for the municipal electric-light plant.

GALLIPOLIS, OHIO.—The Gallipolis El. & Pwr. Co. is rebuilding its station and changing its system from 133 cycles, 1100 volts, to 60 cycles, three-phase, 2300 volts, and is now installing a new 150-kw General Electric alternator, 100-kw turbine, 100-kw rotary converter (500 volts, General Electric), and entirely new switchboards. The rotary converter will be used to supply 600-volt direct-current service to the Gallipolis & Northern Traction Co., to begin about May 1. During the past eight months the company has rebuilt its overhead service system and installed 70 additional street lamps in Gallipolis.

HILLIARDS, OHIO.—The Hilliards Lt. & Pwr. Co., recently incorporated with a capital stock of $10,000, is planning to install an electric-light and power plant in Hilliards, to supply electricity for street-lighting and commercial purposes. Le Roy Bobyns, T. C. Latham and others are interested.

LISBON, OHIO.—The Ohio Gas & El. Co., recently organized, contemplate the installation of an electric-light plant in Lisbon. Joseph S. Grayden and others are interested.

MASSILLON, OHIO.—Plans are being considered by the City Council for the installation of an ornamental street-lighting system. The Massillon El. & Gas Co. furnishes the street-lighting service.

MOUNT BLANCHARD, OHIO.—Bonds to the amount of $3,600 have been issued for the installation of an electric street-lighting system.

NEW BERLIN, OHIO—The Council has awarded the Canton El. Co., of Canton, a contract to light the streets of the village for a period of 10 years, which provides for the installation of 41 arc lamps at $50 each per year and nitrogen incandescent lamps at $18 each per annum.

OXFORD, OHIO—The trustees of Miami University, Oxford, are planning to double the output of the power plant. New boilers and engines, it is understood, will be installed. Walter G. Franz, Union Trust Building, Cincinnati, is consulting engineer.

PAINESVILLE, OHIO.—The City Council has rejected the proposal of the Cleveland, Painesville & Eastern R. R. Co., of Willoughby, to supply electricity for the city of Painesville, and has passed an ordinance authorizing $35,000 in bonds to provide funds for improvements and new equipment for the municipal electric-light plant.

SPRINGFIELD, OHIO.—The Park Board has decided to install an ornamental lighting system along the South Lagoon Driveway.

YORKVILLE, OHIO.—The power plant of the Red Mud Mine of the Russell Coal Co. was recently destroyed by fire.

FORT THOMAS, KY.—Application has been made to the city of Fort Thomas for a franchise to install and operate an electric-lighting system.

HARLAN, KY.—The Kentucky Utilities Co., of Lexington, has begun work on the erection of a new transmission line from Harlan running over the mountains, through Wilhoit and Terry's Fork to Varilla.

LOUISVILLE, KY.—Plans are being prepared by Loomis & Hartmen, architects, Todd Building, Louisville, for the erection of a four-story building for the Speed estate on Fourth Street. Bids, it is stated, on elevators and electric wiring, etc., will be received on June 1.

CHALMERS, IND.—The town of Chalmers is considering the installation of a municipal electric-lighting plant. It is proposed to purchase energy to operate the system.

CONNERSVILLE, IND.—The City Council is considering the installation of a new street-lighting system.

ELKHART, IND.—The City Council is reported to have engaged an engineer to prepare plans for an ornamental lighting system for Main and Second Streets in the business section of the town.

GRABILL, IND.—The Allen County El. Lt. & Pwr. Co., recently incorporated, with a capital stock of $15,000, proposes to supply electricity in six small towns in Allen County. Among the directors are P. S. Amstutz and George Krudop.

HUNTINGTON, IND.—The Board of Works, it is reported, will petition the City Council for an appropriation for the erection of additional distributing lines and street lamps. The amount required is estimated from $3,000 to $12,000.

MARTINSVILLE, IND.—Contracts, it is reported, have been awarded for the installation of two generating units in the electric plant of the Martinsville Gas & El. Co., one 200-kw and the other 250-kw. The company is contemplating extending its transmission lines about 19 miles. The Reliance Engineering Co., Cincinnati, Ohio, has charge of the engineering work.

RICHMOND, IND.—The Liberty Lt. & Pwr. Co., of Richmond, is contemplating extending its transmission lines to Economy, Chester, Fountain City, Williamsburg and Greensfork, to furnish electrical service in those towns. The company has recently secured a contract to supply electricity to the Rheinheimer quarries at New Paris, replacing steam power.

ROCHESTER, IND.—The United Public Service Co., of Rochester, has taken over the property of the Union Wtr., Lt. & Pwr. Co., of Bourbon, and, it is reported, will take over several northern Indiana plants and extend its service lines. Action has been taken by the company relative to authorizing an issue of $1,000,000 in bonds.

ROYAL CENTER, IND.—The capital stock of the Royal Center El. Lt. Co. has been increased from $10,000 to $15,000.

CHICAGO, ILL.—The Chicago Tel. Co. has purchased a site (140 ft. by 180 ft.) just outside of Chicago, on which, it is reported, the company contemplates the erection of a new seven-story exchange building, at a cost $750,000.

CHICAGO, ILL.—A new water-power project, to cost approximately $7,000,000, is to be submitted to the present Legislature, in addition to Governor Dunne's plans to develop the power in the Illinois River at Starved Rock, at a cost of $4,000,000. The site of the $7,000,000 proposition is at the head of Patterson's Island in Desplaines River, a short distance below Joliet. A bill to empower the Sanitary District of Chicago and the State jointly to proceed with the undertaking is now being prepared in the offices of the Sanitary District of Chicago.

MOLINE, ILL.—The People's Pwr. Co., controlled by the Tri-City Ry. & Lt. Co., has decided to discard the switchboard in the Moline plant and erect in its place a board equipped with non-compartment switches of high rating.

MONMOUTH, ILL.—The Public Utilities Commission has granted the Monmouth Pub. Ser. Co. permission to issue $42,000 in bonds.

SHAWANO, WIS.—Options, it is reported, have been taken by the Municipal Light and Water Commission on a dam site and flowage lands on Wolf River for a proposed hydroelectric plant, to cost about $50,000. Plans and estimates are being prepared by the Power Engineering Co., of Minneapolis.

ELMORE, MINN.—The town of Elmore has entered into a contract with the Commonwealth Pwr. Co., of Mankato, to furnish electricity for lamps and motors in Elmore for a period of 20 years. The company will extend its transmission line from Amboy to Elmore.

HIBBING, MINN.—Construction work on the power house to be built at Alice in conjunction with the new water system will be started some time next month, it is reported. R. J. Morehouse is engineer.

REDWOOD FALLS, MINN.—Bids will be received by H. M. Aune, secretary of Board of Education, Redwood Falls, until May 25 for additions and alterations in the high-school building, separate bids to be submitted as follows: (A) general contract; (B) plumbing; (C) heating; (D) electrical contract. Plans and specifications may be obtained after May 13 upon application to Tyrie & Chapman, architects, 320 Auditorium Building, Minneapolis, upon deposit of $15 for general contract, and $10 for each set of plans for B, C and D.

STILLWATER, MINN.—The city lighting committee has engaged Earl D. Jackson, consulting engineer, of St. Paul, to prepare plans for an ornamental lighting system; also plans for lighting system without ornamental lamps and also for a municipal lighting plant.

BRIGHTON, IA.—L. R. Sherrill, of Burlington, it is reported, has been granted a franchise to construct and operate an electric-light plant in Brighton.

CENTERVILLE, IA.—The Centerville Lt. & Trac. Co., it is reported, is contemplating the erection of a transmission line to Cincinnati, a distance of 9 miles. The company proposes to furnish electricity in Cincinnati for street-lighting and commercial purposes and also to the mines along the route. Harry Longnecker is superintendent of the company.

CRESTON, IA.—The Creston Mutual El. Lt., Ht. & Pwr. Co. is contemplating extending its transmission lines to Tingley, Shannon City, Arispe and Diagonal.

INDEPENDENCE, IA.—Bids will be received at the office of E. A. Bordner, auditor of Buchanan County, Independence, until May 24 for construction of a new county home, in accordance with plans and specifications prepared by Henry E. Netcott, architect, Independence. Separate bids will be received as follows: (A) construction of building; (B) for heating and plumbing; (C) electric work. Plans and specifications are on file in the above office, and copies may be obtained from the architect upon deposit of $20, to be refunded upon return of same.

IOWA CITY, IA.—Plans are being prepared by the Iowa City Lt. & Pwr. Co. for rehabilitating its generating station, including the installation of a 1500-kw turbogenerator, a 375-kw waterwheel (directly connected), and a 200-hp Babcock & Wilcox boiler.

ODEBOLT, IA.—The city of Odebolt has granted Russell & Frye, of Corydon, a franchise to construct and operate an electric-lighting plant in Odebolt for a period of 20 years. The cost of the plant is estimated at about $15,000.

ORCHARD, IA.—Options, it is reported, have been secured on sites along the Cedar River for the purpose of building a hydroelectric power plant at Orchard. The company proposes ultimately to furnish electricity in several counties in northern Iowa and southern Minnesota.

UTE, IA.—The installation of an electric-lighting plant (to cost about $10,000) in Ute is under consideration. A company, it is understood, is being organized to construct and operate the proposed plant.

WELLMAN, IA.—B. N. Jessen, it is reported, is contemplating the installation of an electric-lighting system in connection with the tile factory in Wellman.

CHILLICOTHE, MO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 3 for construction, complete (including mechanical equipment and approaches) of the United States post office and court house at Chillicothe. Drawings and specifications may be obtained at the above office or from the custodian of site.

SKIDMORE, MO.—The Mound City El. Lt. & Ice Co., of Mound City, has applied to the Council for a franchise to construct and operate an electric-lighting system in Skidmore. The company proposes to erect a transmission line to Skidmore, via Graham.

BELFIELD, N. D.—The Chrysler Lt. & Pwr. Co. is installing an electric power plant in Belfield. Equipment and machinery for plant has been purchased. The company has not yet purchased material for distributing system, with exception of poles. About 100 110-volt, 60-cycle, 5-amp and 10-amp meters will be required. George S. Chrysler, of Beach, is engineer in charge of the work. Post office address for the present is Beach, N. D.

BROKEN BOW, NEB.—At an election held recently the proposal to issue $10,000 in bonds for the installation of a municipal electric-light plant was carried.

DUNDEE, NEB.—At an election held recently the proposal to issue $35,000 in bonds for the installation of an ornamental street-lighting system was carried.

OMAHA, NEB.—Governor Morehead has vetoed the Saunders municipal light bill passed by the Legislature, on the ground that the bill conferred no rights on the city of Omaha not now possessed, and that the need had been greatly exaggerated. The Senate will be asked to pass the bill over the Governor's veto.

SHELTON, NEB.—At an election held recently the proposal to issue bonds to purchase the plant of the Shelton electric light and power plant was carried.

HAYES, KAN.—The Council is considering the installation of an electric-lighting plant, to cost about $27,000.

Southern States

LAURINBURG, N. C.—Local capitalists, it is reported, have organized a company to furnish electricity for the cotton mill, McNair Phosphate Co., Maxton, and for the mills and the town of Lumberton. The proposed plant will be situated in Laurinburg.

BETHUNE, S. C.—Plans are being prepared by the McBee El. Co., of McBee, for the installation of an electric-lighting system in Bethune. The company would like to receive prices and estimates on 8 miles of No. 6 and 8 miles of No. 4 bare copper wire, 2 miles of No. 6 insulated copper wire, 5000 ft. of No. 8 and No. 10 insulated wire, 10,000 ft. house wire, transformers, street hoods, cross-arms, hardware, insulators, pins, etc.

DENMARK, S. C.—The Denmark Lt. & Pwr. Co. expects to complete within the next two months its power house and to install an additional generating unit, which has already been ordered; also within the next 30 days to erect a cooling tower and outfit and within the next two months to extend its distribution lines, material for which has been purchased. F. M. Stanbrough is manager.

JONESVILLE, S. C.—At an election held recently the proposal to grant a franchise to install an electric-lighting plant in Jonesville was carried.

UNION, S. C.—The Board of Public Works expects to erect within the next two months a 6600-volt, three-phase transmission line to supply electricity to operate pumping station, located 4 miles from city; also to install two feeder panels. All material has been purchased. R. A. Easterling is superintendent.

DUBLIN, GA.—At an election to be held June 8 the proposal to issue $50,000 in bonds will be submitted to the voters. The proceeds of $20,000 will be used for the construction of ice and cold-storage plant (using exhaust steam of present light and water plant); $5,000 for an incinerator; $10,000 for improvements to light and water plant and $10,000 for street improvements.

MACON, GA.—The Central Georgia Pwr. Co., of Macon, it is reported, is contemplating the construction of a hydroelectric power plant on Flint River, 12 miles from Thomaston. The company, it is understood, has contract secured to supply electricity (2000 hp) to the Thomaston Cotton Mills, which will erect an addition, costing $250,000, and will discard steam-power for electricity. The Central Power Co. of Georgia, it is stated, is planning to build a substation and transmission line to transmit electricity from the Ocmulgee River development at Jackson via Barnesville to Thomaston.

ST. PETERSBURG, FLA.—The General Utilities & Operating Co., Munsey Building, Baltimore, Md., is reported to have purchased the property of the St. Petersburg El. Lt. & Pwr. Co. The new owner, it is understood, contemplates improvements to the system, to cost about $50,000.

HUMBOLDT, TENN.—Within the next two months the commissioners of the electric-light and water-works plant expect to install an electrically driven centrifugal pump and to rebuild the electric distributing system. W. M. Case is manager and superintendent.

GADSDEN, ALA.—The City Council is reported to be contemplating replacing steam power in the pumping station with electrically driven machinery.

LAUREL, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 18, for construction complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Laurel, Miss. Drawings and specifications may be obtained at the above office or from the custodian of site at Laurel.

BLYTHEVILLE, ARK.—The Southwestern Utilities Co., which controls power plants in Blytheville and several cities in Missouri, has increased its capital stock from $425,000 to $800,000.

HORATIO, ARK.—An electric-light plant is being installed in Horatio by Messrs. Cowden & Edmonson.

MONROE, LA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 28 for installing a hot-water-heating system, new boiler room and fuel room in the United States court house, post office, etc., at Monroe. For details see proposal columns.

Pacific States

ELLENSBURG, WASH.—Within the next two months the city of Ellensburg expects to ask for bids on a 1000-kw steam turbine and a 325-hp boiler. The city is building an entire new plant, at a cost of $60,000, and will move all equipment from old power station to new power house. E. L. Butler is manager.

SPOKANE, WASH.—The 22,500-hp units in the Long Lake power plant of the Washington Wtr. Pwr. Co. have been installed. As soon as riveting on the penstock for the second unit is completed concrete anchorages will be poured, and then within a few weeks the units will be tested and put in service.

LA PINE, ORE.—The Pringle Falls El. Pwr. & Wtr. Co. is contemplating extending its transmission lines to the towns of Crescent, Fremont and Fort Rock. The company is now installing machinery in its power house at Pringle Falls.

BAKERSFIELD, CAL.—The Lakeview Oil Co. No. 1, it is reported, is contemplating the purchase of an electric generating plant, five 70-hp lathes and other equipment for power house and machine shops. W. J. Burnhart is superintendent.

OAKDALE, CAL.—Surveys are now being made for the proposed electric railway into Hetch Hetchy Valley to be built by the city of San Francisco. The proposed railway will start from Oakdale.

PASADENA, CAL.—Commissioners of the city of Pasadena have adopted a resolution authorizing the installation of an electric-lighting system, to be maintained by underground wires, on North Fair Oaks Avenue. Petitions are being circulated for the installation of ornamental lamps on Southeast Molino Avenue.

SAN JOSE, CAL.—The West Santa Clara Street Improvement Association is considering the installation of ornamental lamps on West Santa Clara Street, to form a portion of the ornamental lighting system which will extend the entire distance from San José to Santa Clara.

TEHACHAPI, CAL.—Bonds to the amount of $8,000 have been voted for the installation of a municipal electric-lighting system. Energy for operating the system will be secured from the Pacific Lt. & Pwr. Corpn., of Los Angeles, which is installing the plant, at a cost of about $11,800, of which Tehachapi is to pay $8,000.

HUNTINGTON, UTAH.—The Huntington Lt., Pwr. & Tel. Co. has filed application with the state engineer for 50 second-ft. of water in Huntington Creek, the water to be used for power purposes.

GILLETTE, WYO.—Preparations are being made by Royal D. Salisbury, of Newcastle, it is reported, for the installation of an electric-light plant in Gillette.

LA JUNTA, COL.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

LOVELAND, COL.—Bonds to the amount of $78,000 have been voted for the installation of a municipal electric-lighting plant.

Canada

BEVERLEY, ALTA.—The Town Council is considering the question of installing an electric-lighting system.

CHATHAM, ONT.—Estimates are being prepared for the Township Council on the cost of the installation of a hydroelectric power system.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until May 13, for furnishing galvanized sheet iron or steel, stay-bolt iron, cast-iron water pipe, bolts, mule shoes, flush pipe, screws, files, transformers, generators, switchboards, electric cable, electric wire, soft-iron wire, fire hydrants, service and valve boxes, etc. Blanks and general information relating to this circular (No. 920) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

Directory of Electrical Associations

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C. Meeting, San Francisco, Aug. 2-7.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual meeting, Deer Park, Md., June 29 to July 2.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, William H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark. Annual meeting, Little Rock, May 11-13.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. President, R. K. Sheppard, B. F. Goodrich Co., Akron, Ohio.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Assistant secretary, Walter Neumuller, Irving Place and 15th St., New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. T. Snyder, McKeesport, Pa. Annual meeting, Hotel Statler, Detroit, Sept. 8-11.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, Rochester, N. Y., June 22-25.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, 10 Adelaide Street East, Toronto, Can.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, J. F. Becker, 130 East 15th St., New York.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russel, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE STATE OF PENNSYLVANIA. Secretary, M. G. Sellers, 1518 Sansom St., Philadelphia.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next quarterly meeting, Detroit, June 15-17.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., New York. Sections in New York, New England, Chicago, Philadelphia, Washington and Los Angeles.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla. Annual meeting, Oklahoma City, May 12-14.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. A. Wier, Athens, Ga.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, C. A. Littlefield, 29 West 39th St., New York. Annual convention, New Willard Hotel, Washington, D. C., Sept. 20-23.

INDEPENDENT TELEPHONE ASSOCIATION OF AMERICA. Secretary, W. S. Vivian, 19 South LaSalle St., Chicago.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skilman, Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, David Sarnoff, 71 Broadway, New York.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ENGINEERING CONGRESS. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, September.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 9-11.

IOWA SECTION, N. E. L. A. Secretary, W. H. Thomson, Des Moines, Ia.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), Homer E. Niesz, Chicago, Ill.; Mercury (secretary,) E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN ELECTRIC ASSOCIATION. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich. Annual meeting June.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the National Electric Light Association. Secretary-treasurer, H. F. Wheeler, Hattiesburg, Miss.

MISSOURI PUBLIC UTILITIES ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis. Convention, May 27.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Chicago, June 1-3.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York. Annual meeting, San Francisco, June 7-11.

NATIONAL ELECTRICAL CONSTRUCTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y. Annual meeting, San Francisco, July 18-24.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederick P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Permanent headquarters, Room 204, Hotel LaSalle, Chicago, Ill.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. E. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, E. A. Thiele, Roswell, N. M.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 365 East 21st St., Brooklyn, N. Y.

NORTHWEST SECTION, N. E. L. A. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual meeting, Cedar Point, July 20-23.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary-treasurer, J. W. Oberender, Portland, Ore.

PENNSLYVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, Pittsburgh, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer, C. E. Rosenberg, Times Building, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General, Manager, J. M. Wakeman, 29 West 39th St., New York. Annual meeting, New York, May 11, 1915.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Ames, Ia., June 22-25.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, George H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex. Annual meeting, Galveston, May 19-22.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, C. H. West, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretaary, George Allison, 1410 First National Bank Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 20, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,135,999. AUTOMATIC LIGHTING CONTROL FOR VEHICLE; J. G. Egerton, Memphis Tenn. App. filed March 16, 1914. Causes tail-light to flicker when car runs backward and shifts from red to green light when running forward.

1,136,044. OSCILLATION-RECEIVING DEVICE; G. W. Pickard, Amesbury, Mass. App. filed July 24, 1911. Members of silicon and antimony.

1,136,045. OSCILLATION-RECEIVING DEVICE; G. W. Pickard, Amesbury, Mass. App. filed July 24, 1911. One member of silicon and other member of arsenic and antimony.

1,136,046. OSCILLATION-RECEIVING DEVICE; G. W. Pickard, Amesbury, Mass. App. filed July 24, 1911. Silicon and bismuth members having rough contacting surface.

1,136,047. OSCILLATION-RECEIVING DEVICE; G. W. Pickard, Amesbury, Mass. App. filed July 24, 1911. Silicon member and arsenic member having rough contacting surface.

1,136,058. SYSTEM OF POWER TRANSMISSION; E. A. Sperry, Cleveland, Ohio. App. filed March 9, 1903. More effective control of translating devices.

1,136,062. ELECTROPNEUMATIC BRAKE; W. V. Turner, Edgwood, Pa. App. filed Aug. 26, 1912. Pressure in an application chamber controls the supply of fluid to and from the brake cylinder.

1,136,075. STORAGE BATTERY; P. B. Whitney, New York, N. Y. App. filed Jan. 21, 1915. For motor vehicles; can be used in upright or horizontal position.

1,136,076. PROCESS OF PRODUCING ELECTRICAL HEATING DEVICES; E. L. Wiegand, Canal Dover, Ohio. App. filed Jan. 9, 1914. Plastic mass compressed about coil and vitrified.

1,136,078. ELECTRIC-CURRENT GENERATOR; J. M. Wilson, Newark, N. J. App. filed Nov. 11, 1912. For motor vehicles.

1,136,111. DOWEL CONNECTION; R. W. Erwin, Fremont, Ohio. App. filed Sept. 29, 1913. For dry cells; uses a corrugated carbon.

1,136,127. ELECTRICALLY HEATED TOOL; J. S. Hansen, Brockton, Mass. App. filed Aug. 24, 1912. Treeing iron for smoothing the uppers of boots and shoes.

1,136,139. CORNER-TURNING INDICATOR FOR AUTOMOBILES; S. Jackson, Denver, Col. App. filed June 1, 1914. Sounds alarm as well as indicating the intended direction.

1,136,194. DEVICE FOR MOTION-PICTURE PRINTING; A. Wolfsohn, New York, N. Y. App. filed Dec. 26, 1913. Automatically changes the light for different scenes.

1,136,195. SYSTEM OF MOTOR CONTROL; E. C. Woodruff, State College, Pa. App. filed Jan. 17, 1914. Automatic, successively acting contact devices.

1,136,211. BOILER CUT-OFF SYSTEM; G. W. Collion, Bridgeport, Conn. App. filed July 13, 1914. Automatic operation.

1,136,215. MAGNETIC SEPARATOR; M. Dings and R. A. Manegold, Milwaukee, Wis. App. filed Aug. 7, 1911. Avoids zones of little attraction in magnetic pulley.

1,136,227. OZONATOR; L. Goldberg, Indianapolis, Ind. App. filed Aug. 5, 1914. Cylindrical electrodes on opposite sides of a single dielectric.

1,136,228. TROLLEY RETRIEVER; J. F. Gundry, Flint, Mich. App. filed Sept. 3, 1912. Has two retiring reels of different tension.

1,136,233. METAL-WORKING SWITCH; A. C. Johnson, Chicago, Ill. App. filed July 26, 1913. For providing a record of the operation of a lathe or other machine.

1,136,240. ELECTRIC SWITCH; C. J. Klein, Milwaukee, Wis. App. filed Aug. 26, 1912. Push-button socket.

1,136,279. POWER-TRANSMITTING DEVICE; M. L. Severy, Arlington Heights, Mass. App. filed March 26, 1912. Electro-inductive transmission for autos.

1,136,283. MOUTHPIECE PROTECTOR FOR TELEPHONE TRANSMITTERS; C. T. Smith, Newark, N. J. App. filed Feb. 6, 1914. Mouthpiece cover operated from receiver hook.

1,136,284. MOUTHPIECE PROTECTOR FOR TELEPHONE TRANSMITTERS; C. T. Smith, Newark, N. J. App. filed July 17, 1914. Hinged, automatically operated cover sections attachable to standard desk set.

1,136,312. THERMOSTATIC CONTROL FOR ELECTRIC MOTORS; D. P. Cartwright, Fort Wayne, Ind. App. filed Sept. 28, 1914. Current to motor is diverted at predetermined intervals.

1,136,314. CIRCUIT CLOSER FOR TROLLEY SIGNAL SYSTEMS; R. V. Cheatham, St. Matthews, Ky. App. filed June 4, 1912. Closes circuit when trolley approaches from one direction.

1,136,324. SWITCH BOX; C. A. Erichson, Stamford, Conn. App. filed March 12, 1914. Locking ignition switch.

1,136,337. SELECTIVE SIGNALING SYSTEM; R. N. Hill, Bloomfield, N. J. App. filed Oct. 15, 1913. Train dispatching.

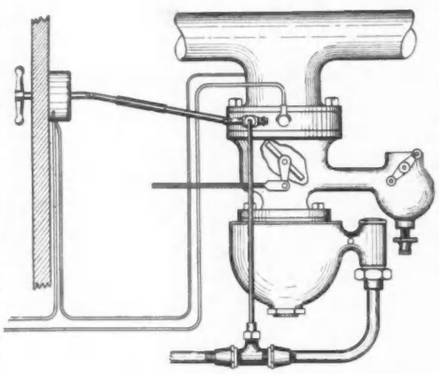
1,136,347. TELEPHONE-EXCHANGE SWITCHBOARD; C. O'D. Lee, Jr., Baltimore, Md. App. filed Jan. 7, 1914. Reduces number of operators required during inactive hours.

1,136,350. ELECTRICALLY DRIVEN CLOCK AND OTHER ELECTRICALLY DRIVEN RUNNING MECHANISM; R. M. Lowne, Catford, Eng. App. filed Nov. 18, 1911. Special contact mechanism.

1,136,355. MUSICAL DEVICE; E. S. Mayland, New York, N. Y. App. filed March 6, 1913. Electromagnetically operated bells or chimes.

1,336,365. ELECTRIC WATER HEATER; C. H. Quinlan, Amsterdam, N. Y. App. filed July 1, 1914. Attachable to water faucet.

1,136,383. CASE FOR INCANDESCENT ELECTRIC LAMP SOCKETS; A. Weber, Sr., Schenectady, N. Y. App. filed Aug. 4, 1906. Cap and shell lock.



1,136,845—ELECTRIC VAPORIZER

1,136,402. SIGNAL; E. O. Branington, Rochester, N. Y. App. filed July 11, 1913. Auto rear signal; has differently colored lenses.

1,136,406. WATER SYSTEM; J. W. Butts, Atlanta, Ga. App. filed July 21, 1913. Opening faucet closes switch for pump motor.

1,136,407. THERMAL CIRCUIT CLOSURE; J. Carrigan, Seattle, Wash. App. filed July 3, 1913. Adjustable thermostat construction.

1,136,424. ELECTROLYTIC PROCESS FOR THE EXTRACTION OF COPPER; N. V. Hybinette, Christiania, Norway. App. filed May 22, 1913. Upon material containing the copper partly as oxide and partly as sulphide.

1,136,433. TRANSPOSITION DEVICE FOR ELECTRIC LINES; G. N. Neel, Dublin, Tex. App. filed July 6, 1914. Readily attachable, maintains lines parallel and is indestructible.

1,136,449. MICROPHONE; C. W. Underwood, Crowley, La. App. filed May 27, 1914. Has parallel agitating blades projecting into the granular conducting material.

1,136,472. KNIFE-BLADE SWITCH; G. E. Linton, Worcester, Mass. App. filed Sept. 30, 1911. Switch terminal clips secured to their bases by wedges.

1,136,477. TRANSMITTING APPARATUS FOR USE IN WIRELESS TELEGRAPHY AND TELEPHONY; G. Marconi, London, Eng. App. filed Dec. 31, 1913. Includes condensers in parallel.

1,136,483. PROCESS AND APPARATUS FOR TREATING ORES; L. E. Porter, Los Angeles, Cal. App. filed Aug. 27, 1914. Raw ore passed directly into electrolytic cell.

1,136,508. CALL-DISTRIBUTING SYSTEM; H. P. Clausen, Mount Vernon, N. Y. App. filed Feb. 10, 1914. For automatically connecting calling lines to idle trunks.

1,136,593. ARC LAMP; R. Fleming, Indianapolis, Ind., and A. B. Halvorson, Jr., Saugus, Mass. App. filed March 6, 1905. Compensator intermediate between the line and the lamp mechanism.

1,136,601. GUARD; T. B. Harris, Jacksonville, Fla. App. filed May 16, 1914. Signals attempt to operate fire-alarm box and holds operator captive.

1,136,602. PROGRAM CLOCK; C. O. Heon, Portage, Wis. App. filed Jan. 28, 1913. Has plurality of contact elements which can be set to be engaged by hour hand.

1,136,621. MOTOR CONTROLLER; W. M. Shallcross, Milwaukee, Wis. App. filed Jan. 6, 1913. Provides series parallel connections for motors and can be used to cause them to act as dynamic brake.

1,136,639. CIRCUIT CONTROLLER; P. H. Zimmer, Milwaukee, Wis. App. filed March 1, 1913. Switching members and latch mechanism.

1,136,657. OVERLOAD PROTECTIVE DEVICE; W. E. Date, Westfield N. J. App. filed Dec. 18. 1913. Arranged to allow more current for starting.

1,136,668. MOTOR CONTROLLER; M. M. Goldenstein, Milwaukee, Wis. App. filed Oct. 10. 1913. Particularly for printing presses.

1,136,680. ELECTRIC SWITCH; C. J. Klein, Milwaukee, Wis. App. filed Sept. 25, 1911. Push-button lamp socket.

1,136,681. SWITCHING SOCKET OR CONNECTOR; G. C. Kanuff, Chicago, Ill. App. filed Dec. 12, 1913. For auto lighting systems; permits breaking circuit without detaching plug.

1,136,683. WIRELESS RECEIVING APPARATUS; J. S. Leach, Brooklyn, N. Y. App. filed Dec. 12, 1913. Telephone receiver with means for adjusting distance between diaphragm and magnet poles.

1,136,684. INDUCTION LIGHT SYSTEM; J. Ledwinka, Philadelphia, Pa. App. filed Feb. 25, 1913. Energy for producing incandescence of the filament is derived through induction.

1,136,687. MUFFLER ATTACHMENT FOR TELEPHONES; J. Litt, Philadelphia, Pa. App. filed March 2, 1914. Spring clamp attaches it to telephone mouthpiece.

1,136,688. STARTING DEVICE FOR INTERNAL-COMBUSTION ENGINES; W. D. Lutz, Allendale Borough, N. J. App. filed Oct. 8, 1913. Special clutching mechanism between starting motor and the engine.

1,136,737. ELECTRIC SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed July 10, 1914. Flush-type, push-button switch.

1,136,750. ELECTRIC TRAIN SIGNALING AND CONTROLLING SYSTEM; A. J. Allard, Richmond, Va. App. filed June 2, 1913. Contact-rail system.

1,136,751. ELECTRIC-TRAIN SIGNALING AND CONTROLLING SYSTEM; A. J. Allard, Richmond, Va. App. filed July 30, 1913. Contact rails energized upon failure of the track or live circuits.

1,136,779. SUSPENSION DEVICE OF MOTORS ON TRAMWAY OR RAILROAD MOTOR CARS; C. Delmez, Antwerp, Belgium. App. filed July 17, 1913. Axle boxes are replaced by ball bearings.

1,136,781. BELL-RINGING DEVICE; H. D. Elliott, Skamokawa, Wash. App. filed July 23, 1914. Has a revoluble clapper for rapidly striking the bell.

1,136,803, TROLLEY REPLACER; G. D. Huppes, Springfield, Ohio, App. filed Nov. 18, 1913. Spiral replacing wheels at opposite sides of trolley wheel.

1,136,810. DEVICE FOR THE COMPARISON OF CURRENT TENSION AND POWER BY SELF-ACTING RESISTANCES; M. Kallmann (deceased), Berlin, Germany. App. filed July 12, 1909. For testing electric meters.

1,136,814. AUTOMATIC DIRECTION INDICATOR; N. W. Kliehman, Brooklyn, N. Y. App. filed April 8, 1914. Has swinging indicating arrows carrying lamps.

1,136,838. SELECTIVE CALL DEVICE; H. O. Rugh, Sandwich, Ill. App. filed Aug. 26, 1912. Push-buttons at central station cause call box to automatically call desired stations.

1,136,845. ELECTRIC VAPORIZER; C. G. Tate, Chicago, Ill. App. filed Feb. 15, 1913. Quick-acting and attachable to standard motor.

1,136,907. ARMATURE FOR ELECTRICAL MACHINES; R. M. Warren, Sumter, S. C. App. filed Nov. 22, 1913. Laminated core construction.

1,136,912. TELEPHONE REPEATER SYSTEM; T. G. Martin, Chicago, Ill. App. filed April 16, 1910. Automatic trunking.